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Cover
TOMRA XRT machines at Lucara's Karowe diamond mine in Botswana. As our cover story on page 18 explains, TOMRA's XRT technology provides a single-stage alternative to traditional concentration and recovery techniques used in the diamond mining industry.

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Rare earths market shows tentative signs of a revival

Every now and then we have a mineral or family of minerals that – for one reason or another – becomes the hottest commodity around. The result is a price spike, which in turn tends to set off intense activity by junior miners and explorers in anticipation of prices continuing to rocket – which rarely happens.

The reasons for these sudden price rises can sometimes be trivial. Some readers might recall, for example, the coltan (columbite-tantalite) boom of 2000, which lasted for a few months. I don't know how true it is but the increase in demand for coltan which drove this boom was – according to some accounts – precipitated by the introduction of a new version of the PlayStation, an electronic gaming system which uses the metals derived from coltan in its circuitry.

Following the pattern seen with coltan, the prices of rare earth elements (REEs) went through the roof in 2011, occasioned by fears that China – the world's biggest producer – would reduce supply to the world market. The surge was short lived and, in September 2015, prices hit a five-year low.

While coltan has never really returned to favour, there are signs that the rare earths market could be making a comeback, driven by ever-growing demand for certain of the rare earth elements – notably dysprosium, praseodymium and neodymium – used in a variety of high-tech applications including the manufacture of powerful 'rare earth magnets'.

In addition, there is a growing unease over the virtual Chinese monopoly over rare earths production. Indeed, it was interesting to see in a recent Senate hearing in the US that this very subject came up, with the senior Senator from West Virginia, Joe Manchin III, pointing out that the US was now totally dependent on foreign – and mainly Chinese – sources of REEs following the closure of Molycorp's Mountain Pass mine in California.

Asked whether this was a concern, CIA Director Mike Pompeo said it was and emphasised that REEs remained vital for the development of "important technologies to keep us all safe."

Certainly Africa has the potential to reduce the current dependence on Chinese production with some superb deposits scattered around the continent, including South Africa itself.

One African project that has already entered the trial mining phase is Rainbow's Gakara project in Burundi, which we cover in this issue (see page 22), while another which looks highly promising – though somewhat further from commercial production – is Peak Resources' Ngualla project in Tanzania

Gakara is characterised by an amazingly high grade but it will be a small project – the capex is just US$2,2 million – accounting for only a tiny portion of world production. Ngualla, on the other hand, is a much bigger development which includes not only a mine and plant on site in Tanzania but also a refinery in the UK. It will cost – according to the recently published BFS (see page 12) – a hefty US$356 million to bring into production.

The main South African rare earths project is Zandkopsdrift, located 450 km north of Cape Town in the Northern Cape. Although a PFS on Zandkopsdrift was completed in 2015, the project appears to be becalmed to judge from the lack of news on the website of Frontier Rare Earths, the Canadian company which is developing it.

There is also, of course, the Steenkampskraal project in the Western Cape, which started life as a thorium mine in the 1950s. Canada's Great Western Minerals Group planned to redevelop Steenkampskraal as a rare earths mine but hit financial problems and the project is now owned by Steenkampskraal Thorium Limited (STL), a South African company. I know very little about STL but I gather it intends reopening the mine, with the emphasis being on the production of thorium as much as the rare earths.

In north-western Namibia there is the Lofdal project of Namibia Rare Earths, another Canadian company. A PEA on Lofdal was completed in late 2014 and in November last year the company reported that it had filed an application for a mining licence. Since then, nothing much seems to have happened although the company claims to be focused on the "accelerated development" of the project, which would produce 1 500 t/a of rare earth oxide concentrate and cost about US$160 million to bring into production.

Given the slow progress on projects such as Zandkopsdrift and Lofdal, I don't think anyone would argue that we're on the brink of a rare earths mining boom in Africa. Nevertheless, the situation is more promising than it has been in years. Rare earth prices remain low but, as I've mentioned, the demand outlook is very positive and could well translate into several new mines over the next three or four years. Ngualla looks like the cream of the African crop but others have clear potential and could certainly be developed given the right price environment.

Arthur Tassell

"While coltan has never really returned to favour, there are tentative signs that the rare earths market could be making a comeback, driven by ever-growing demand for certain of the rare earth elements."

Fekola gold project on target for October 2017 start-up

B2Gold Corp, listed on the TSX and NYSE MKT, reports that construction of its Fekola gold project in Mali remains approximately three months ahead of the original two-and-a-half year construction schedule and on budget with production expected to start on target on 1 October this year. At the end of the first quarter of this year, the project was approximately 75 % complete.

Development of the open pit continued to progress ahead of schedule, with a total of 2,6 Mt of waste and 200 000 tonnes of ore mined during the quarter. The first phase of the mining fleet is on site and machines in operation include six Cat 777E haul trucks and two Cat 6020B excavators. Through the quarter average daily mining rates have increased from 25 000 tonnes to 42 000 tonnes. The second grade control drilling campaign commenced in the third week of March 2017.

Installation of the ball and SAG mills at the process plant started in February 2017, following arrival and preparation of the components in January 2017. Concrete works and structural steel erection at the mill are approximately 99 % and 94 % complete, respectively. Concrete work and platework at the primary crusher and stockpile feed conveyor have been completed while approximately 80 % of the structural steel at the primary crusher has been erected.

Installation of pipe supports, pipework, mechanical equipment and electrical cables continued site wide. Instrumentation installation at the leach and CIP tanks, leach thickener and tailings thickener also commenced during the quarter.

Earthworks construction of the phase 1 tailings storage facility (TSF) embankment has been completed and the HDPE lining of the facility has been installed. The network of under-drains in the basin of the TSF, which aids in consolidation of the tailings and extending the life of the facility, is also in place.

The first of the three decant structures, designed to return water back to the process plant, has been finished along with the decant access road above the HDPE liner. The TSF and the site water management structures are approximately 98 % and 93 % complete, respectively. Construction of the run of mine (ROM) pad continued through the quarter with over 1,7 million m^3 of material placed to date and 750 000 m^3 of material placed during the quarter.

The manpower on site saw an increase through the first quarter with an average of 1 050 employees and contractors.

The Fekola plant under construction showing the leach thickener and the CIC section. The plant will have a throughput capacity of 5 Mt/a (photo: B2Gold).

A recent night view of the gold plant at Fekola. At the end of the first quarter of this year, the overall project was approximately 75 % complete (photo: B2Gold).

Fekola – located to the south of Randgold's Loulo-Gounkoto complex – will be a major gold producer. Based on updated mine production plans, it will produce an average of 375 000 to 400 000 ounces of gold a year for the first five years of production and 365 000 to 390 000 ounces a year for the first seven years.

It is similar in design to B2Gold's highly successful Otjikoto mine in Namibia but on a larger scale and is being built by the same construction team.

Ferrum Crescent gives up on Moonlight

Ferrum Crescent, listed on the ASX and AIM, says that detailed negotiations with a third party group in relation to the potential development of the company's Moonlight iron ore project in Limpopo Province have now ceased without reaching any viable agreement.

Consequently, Ferrum's board has decided, unless an alternative development opportunity can be secured in the short term, to undertake an orderly winding-up and hand-over process of all of the company's operations and licences associated with the project with a view to terminating all activities and expenditures in South Africa as soon as practicable.

The company has been incurring approximately A$450 000 per annum in licence-related commitments, as well as staffing, contractual and other associated costs, in order to maintain the project in good standing.

Commenting, Justin Tooth, Executive Chairman of Ferrum, said: "The company has spent considerable time, effort and resources in searching for the right development partner for the Moonlight project to help address the significant headwinds of the global iron ore market environment. The Board has explored conventional technology routes and, more recently, certain new technological advancements which potentially offered lower capital requirements and operating expenses.

"However, despite our best endeavours, we have been unable to secure a path for the development of the Moonlight project and are mindful of the significant costs associated with continuing to hold and maintain the project. I would like to thank our staff in South Africa who have worked relentlessly towards creating value. This difficult decision is a consequence of the challenging circumstances pertaining to the Moonlight project, South Africa and the global iron ore price and is by no means a reflection on their efforts.

"The significant size, location and nature of this bulk mineral asset mean that many factors of production have to be aligned at the right price and this is simply not the case for now. The company will now focus on the mobilisation and initiation of its first drill programme at its Toral lead-zinc project in northern Spain which in itself is an exciting milestone for the company."

Platreef financing takes a step forward

Robert Friedland, Executive Chairman of TSX-listed Ivanhoe Mines, and Lars-Eric Johansson, President and CEO, have announced that the company has appointed three leading mine-financing institutions as Initial Mandated Lead Arrangers (IMLAs) to arrange debt financing for the ongoing development of the company's Platreef mine near Mokopane.

The companies are Export Development Canada, Nedbank Limited (acting through its Corporate and Investment Banking division) and Societe Generale Corporate & Investment Banking.

The three IMLAs will make best efforts to provide approximately US$450 million toward a total debt financing of up to US$1 billion for the development of Platreef's first-phase 4 Mt/a mine. The financing will be contingent upon a successful due diligence process including benchmarking the project against the International Financial Corporation (IFC)'s Environmental and Social Performance Standards.

"This is a major step in the development of the Platreef project, which has the potential to become the world's largest producer of platinum group metals," said Friedland.

"The selected institutions bring extensive experience in structured mining finance in South Africa and internationally. Their support gives us strong confidence in our ability to advance the near-term development of Platreef and confirms that it is viewed as one of the world's most attractive greenfield platinum group metals projects."

Added Johansson: "With the appointment of the IMLAs, our next step in arranging the project debt financing is the completion and issuance of the definitive feasibility study for Platreef's first-phase production scenario, which we expect this quarter."

The headgear of Shaft 1 at the Platreef site (photo: Ivanhoe).

The feasibility study is being prepared by principal consultant DRA Global, with specialised sub-consultants including Stantec Consulting, Murray & Roberts Cementation, SRK Consulting, Golder Associates and Digby Wells Environmental.

On April 12, 2017, Ivanhoe announced approval for the start of early-works construction for Platreef's Shaft 2, which will be the project's main production shaft. Shaft 2 will be located approximately 100 m north-east of Platreef's Shaft 1, where permanent sinking has been underway for over eight months.

Ivanplats plans to develop the Platreef mine as an underground mining operation in three phases, with phase one having an initial annual rate of 4 Mt/a to establish an operating platform to support future expansions. Phase 2 will see a doubling of production to 8 Mt/a while Phase 3 will take production to a steady-state 12 Mt/a. At a projected production rate of 12 Mt/a, Platreef would be the largest PGM mine in the world, producing more than 1,2 Moz of platinum group metals each year. ■

Beltcon 19 – Materials Handling Conference and Exhibition

Beltcon 19, the International Materials Handling Conference and Exhibition, is to be held at St George's Hotel, Pretoria, from 2–3 August 2017.

Beltcon is recognised as one of the foremost international conferences bringing progress, breakthrough research and state-of-the-art information to members of the industry. It is a conference that through the years has gained global stature by attracting eminent and knowledgeable researchers and speakers. Among the distinguished speakers from around the world are Zamorano, Chile; Dharma and Suresh, India; Wiid and Schmitz, South Africa; Porter and Wheeler, Australia; and Zhang, USA.

Some of the topics to be covered are: dynamic and fatigue analysis of bulk materials; conveyor system capacity upgradation design considerations; technical evaluation of coal silo failure mechanisms; energy efficient rail conveyors; conveyor belt fire safety; active winch take-up systems; overland conveyor design; and troughed belt turnover finite element analysis.

Beltcon will run concurrently with an exhibition of products relevant to the conveying industry which is within the conference venue and therefore open to delegates only.

Beltcon is supported by the Conveyor Manufacturers Association and is organised by Cost Time Resource. Full details plus an application form are available on the Beltcon web site: *www.beltcon.org.za*. ■

Alphamin appoints contractors for its Bisie tin project in the DRC

Alphamin Resources Corp, listed on the TSX-V, reports that construction of the mine boxcut and upgrade of the access road at its Bisie tin project in the DRC's North Kivu Province has started following the mobilisation of two earthworks contractors to site and the appointment of the mining contractor.

The recent completion of the Front-End Engineering Design (FEED) programme and associated Control Budget Estimate (CBE) by DRA Projects, the engineering, procurement and construction contractor for the project, confirmed the robust economic metrics and potential of the project, which will rank as North Kivu's first commercial mine.

The completed FEED and CBE increase proven and probable reserves to 4,67 Mt at 3,58 % Sn containing 16,3 kt of tin. The optimised process flow sheet resulted in 6 % higher annual average plant throughput rates and an increase in tin recoveries to 73 %.

The borehole drilling to prove the current reserves and provide mine planning has been carried out to a depth of 550 m below surface and 720 m down plunge. This results in a current planned life of mine of 12,5 years producing an average of 373 800 tonnes of ROM per annum.

Alphamin has appointed Kongo River SA and VRSC SARL as the project's earthworks contractors and Reliant Congo SARL as the project's Phase I mining contractor. The appointment of these contractors followed a stringent due diligence process and evaluation of each potential contractor's safety records, submitted schedules, DRC experience, technical capacity and price.

VRSC has worked on the construction of Banro Corporation's gold mines in South Kivu Province and the Kibali gold mine in the north-eastern corner of the DRC.

Reliant operates in the DRC and Zambia and reportedly has a strong track record of safety and production. It has worked for Glencore in the DRC and continues to mine for Glencore in Zambia and Vedanta Resources in India. The company is in the process of mobilising its equipment to begin developing the decline in early July 2017 in accordance with the project implementation schedule.

"It is very encouraging that work has commenced, and subject to finalisation of the full funding solution, the project is expected to be completed on time, and within budget, by the end of Q1 of 2019," says Boris Kamstra, CEO of Alphamin Resources Corp.

"A total of 22 heavy earthmoving machines, their operators, management, and support have been deployed for work at the Mpama North site and on the access road. The work on the boxcut and the continued upgrading of the 34 km access road have already commenced, following the completion of the initial 9 km of the access road upgrade to enable the carrying of normal traffic. The access road is expected to be completed by December 2017."

In addition, the return airway has advanced to 97 m, and the orebody is expected to be intersected at 120 m.

Alphamin says that significant progress has been made towards finalising the funding package for the project. Funding will include a combination of debt, equity and an equity standby facility. ■

Consultants selected for Namdini

ASX-listed Cardinal Resources has engaged Lycopodium Minerals and Golder Associates to complete the next study phase at its Namdini gold project in the far north of Ghana.

Lycopodium will deliver a process prefeasibility study comprising the process, associated infrastructure and tailings facilities while Golder will undertake a mine scoping study. The studies are expected to commence shortly with completion estimated in late Q3 2017.

The Namdini deposit comprises a mineralised system of up to 300 m in width and extending over 1 km. Gold mineralisation is characterised by disseminated sulphides in sheared Birimian greenstones (metavolcanics intruded by granite and diorite). In November last year Cardinal declared a 4 Moz maiden JORC resource at Namdini. ■

A recent view of the Nkran pit of the Asanko Gold Mine. Akwasiso will provide incremental ounces that have lower mining and processing costs than the current Nkran operations (photo: Asanko Gold).

Asanko Gold updates Akwasiso resource

Asanko Gold Inc, listed on the TSX and NYSE MKT, has announced an updated mineral resource and reserve estimate for the Akwasiso deposit, part of the Asanko Gold Mine (AGM) located in Ghana. This follows the successful completion of the infill drilling campaign to upgrade previously reported inferred resources into the indicated category.

Compared to the December 31, 2016 mineral resource estimate (MRE), the updated Akwasiso MRE has increased indicated resources by 79 % to 6,72 Mt at 1,49 g/t for 322 500 contained gold ounces. The resource grades have improved significantly by 24 % from 1,20 g/t to 1,49 g/t. The updated MRE has been signed off by CSA Global (UK) Ltd.

The design of the open pit has been revised on the basis of the updated MRE and geological model, resulting in a 62 % increase in mineral reserves (compared to December 2016), which now total 3,83 Mt at 1,74 g/t for 214 500 contained gold ounces. Grades have also increased by 26 % compared to the December 2016 reserve estimate of 1,38 g/t.

Akwasiso is now the largest satellite deposit within the AGM multi-pit complex. Mining at the deposit is scheduled to begin in Q1 2018.

Akwasiso is located approximately 3 km north-east of the processing facility, which is being upgraded to 5 Mt/a, and will provide incremental at-surface ounces that have lower mining and processing costs than the current Nkran operations.

"It is pleasing to note that the prospectivity of our large scale tenement package in Ghana continues to deliver significant low cost ounces," comments Peter Breese, Asanko's President and CEO. "Since acquiring the deposit in mid-2016, we have spent just US$8 per resource ounce on the drilling programme at Akwasiso and added significant reserves at quality grades, all within a short trucking distance of our processing plant.

"The significant increase in Akwasiso's reserves further boosts the near-term, near mine ore inventory available to support the increased mill throughput to 5 Mt/a.

"With ore containing more than 166 000 ounces already pre-developed at Nkran, which don't require any further capital development to access, 130 000 ounces of at-surface reserves at Dynamite Hill and 214 000 ounces of reserves at Akwasiso, we have more than sufficient ore inventory to maintain our 2017 production profile and to support the expanded production profile of the Asanko Gold Mine in 2018 and 2019 whilst we build the conveyor and bring Esaase into production. With the significant contribution from at-surface ounces, we expect to benefit from both an increase in production as well as the corresponding decrease in costs over this period."

Asanko Gold recently reported its results for the first quarter (Q1) of 2017. A record gold production of 58 000 ounces was recorded for the three-month period.

Ore mining rates for the quarter averaged 339 096 tonnes per month at an average mining grade of 1,8 g/t. Waste mining took place in the north and western sides in preparation for the next sequence of ore mining in the centre of the pit. The next pushback sequence will commence during Q2 2017.

The processing plant continued to operate at an annualised rate of 3,6 Mt/a (20 % above design) during the quarter. ■

Conference on coal processing coming up

The biennial Southern African Coal Processing Society Conference and Exhibition is to be held on 22, 23 and 24 August 2017, with registration and a cocktail opening taking place on 21 August. The theme is 'Coal Processing – the key to profitability'. The venue is Graceland Hotel Casino and Country Club, Secunda. Registration forms are available on *www.sacoalprep.co.za*. Further details can be obtained from Gerda Craddock, tel (+27 11) 432-8918, e-mail: *gerdac@mineralconcepts.co.za*. ■

Two new gold discoveries at Golden Hill

Teranga Gold Corporation, listed on the ASX, has announced two new gold discoveries from its exploration programme at Golden Hill, its joint venture with ASX-listed Boss Resources in Burkina Faso.

The company's new discoveries are located within the Ma and Nahiri prospects, representing the first two of the ten drill ready targets that have been identified to date at Golden Hill. All ten targets are within close proximity to each other.

"The assay results for Ma and Nahiri are very encouraging for an early stage exploration programme," said David Mallo, Teranga's Vice President, Exploration. "They display good grades, widths, continuity and strike length in each prospect, and the mineralised zones occur from surface with good oxide depth developed."

Additionally, the next two targets – Jackhammer Hill and Pourey-Peksou – were also drilled during the first quarter. Teranga says that while these assay results are pending, drilling intersected the expected alteration and structures at each of these targets.

"Overall, we are excited by these positive results, especially given their close proximity to one another," said Mallo. "Based on the success of this first phase, a multi-drill second phase programme on these targets has begun."

The Golden Hill property is located within the highly mineralised Houndé greenstone belt in Burkina Faso. This belt hosts a number of high-grade gold deposits, including the recently discovered Siou, Yaramoko and Houndé deposits. To the south of Golden Hill is another large land position where active exploration programmes are well underway. ■

Important step forward for Sese Joint Venture

ASX-listed African Energy Resources reports that Botswana's Ministry of Finance and Economic Development has approved the Sese Joint Venture (JV)'s application for a Manufacturing Development Approval Order (DAO) for the proposed 450 MW Sese power station

Sese Power, the JV entity responsible for power generation, has been granted a five-year tax holiday from its first year of commercial operation and thereafter a preferential 15 % company tax rate. The company is now required to enter into a formal tax agreement with the Government of Botswana which requires the approval of the National Assembly of Botswana, subsequent to which it will become a Statutory Instrument under the Tax Act.

Approval of the DAO is another important step towards completing the permitting of the Sese coal and power project, with the Generation and Export Licence being the only major outstanding permit required before the project can commence.

The Sese JV is planning the development of an integrated coal mine and power station in Botswana for the delivery of power to Zambia and neighbouring countries. ■

Kibali gold mine heads for full production

The Kibali gold mine's underground operation, which will significantly increase production, is on track to start commissioning in the third quarter of this year, Randgold Resources Chief Executive Mark Bristow said at a media briefing at the mine recently.

Kibali is forecast to deliver approximately 610 000 ounces of gold this year, up from 585 000 ounces in 2016, but annual production is scheduled to rise to around 750 000 ounces from 2018, when the underground operation will make it fully functional.

Ambarau, the second hydropower plant at Kibali, was commissioned in February this year (photo: Randgold).

Bristow noted that Kibali ended 2016 with a creditable performance after having to contend with a range of operational challenges as well as the constraints imposed by limited open-pit mining flexibility.

In addition to dealing with these issues, the Kibali team succeeded in keeping the underground development on track, successfully constructing and commissioning four ultrafine grind mills in the metallurgy circuit, as well as progressing work on the mine's second new hydropower station which was commissioned in February this year. The third and last of the new hydropower stations is currently being built by an all-Congolese contracting group.

"Kibali has stayed on course to become one of the world's great gold mines despite the challenges of last year and the

volatile political climate in the DRC at present," Bristow said.

"Randgold remains committed to the DRC and is confident that its government, politicians and civil society have the will as well as the capacity to work together to secure the country's future. We therefore continue to invest in exploration here and to lead the way in developing the north-eastern DRC as a major new gold mining region. Our engagement with the country and its people is also evident in our substantial investment in local economic development and community upliftment programmes. These include macro and micro agribusinesses designed not only to provide regional food security but to generate surplus produce for export."

It was a source of concern, however, that the DRC government had once again signalled its intention of reviewing the country's 2002 mining code with the clear intention of maximising state revenue, Bristow said. This could have a very negative impact not only on the mining industry but also on the economy.

"Now more than ever the DRC should be focused on retaining its existing investors and attracting new ones. It's certainly not the time to harvest more from less for short term gain. It's my sincere hope that this time round the government will engage the mining sector fully in the proposed review to achieve an outcome that will be in the best interests of the Congolese economy as well as the country's mining sector," he said.

"The existing code is in fact a good one but it is not always being applied effectively and there are still many mining operations that do not operate under the code. There are also a number of issues and challenges which mining companies are having to face which make operating in the DRC more challenging. In Kibali's case, these issues include more than US$200 million in unpaid TVA and duty refunds." ■

Pre-Feasibility Study indicates strong returns for Acacia's Riversdale project

ASX-listed Acacia Coal has announced that a Pre-Feasibility Study (PFS) has found that its flagship Riversdale Anthracite Colliery (RAC) project in South Africa will generate strong financial returns for shareholders.

The study shows that the project is estimated to cost just A$24 million to build on an outsourced operational model, with sustaining capital of A$7,85 million and is forecast to generate an average 438 000 tonnes of sales per annum for an initial eight-year mine life.

Based upon an average selling price of A$125,1/tonne FCA mine gate and an effective 6 % royalty rate, the project study demonstrates a cash margin after tax of A$34,40/t.

The PFS found that these financial parameters would result in an outstanding internal rate of return of 53 % and underpin a net present value at a 10 % discount rate of A$73 million.

Acacia Managing Director Hugh Callaghan said the combination of the extremely high quality nature of the RAC coal and the declining inventory of metallurgical coal in South Africa was at the heart of the project's strong outlook.

Metallurgical test work conducted as part of the PFS found the RAC coal was ideal for use in South Africa's ferrochrome industry, which is struggling to source sufficient quantities of low phosphorus and low sulphur anthracite.

Callaghan said these factors were responsible for the strong price environment which, when coupled with RAC's low costs, would enable the project to enjoy robust margins.

"The PFS shows that the RAC project ticks every box, ranging from a premium-quality product through to low costs and strong margins," he said. "The project is ideally placed to capitalise on the strong supply-demand fundamentals in the South African premium metallurgical coal market. There is also encouraging potential to grow the mine life with further drilling of both the Gus and Alfred seams."

The PFS, led by VBKom, examined all aspects of geology, mining, processing and supporting infrastructure at market prices for anthracite, to a nominal accuracy of ±15 %.

The trade-off and detailed optimisation studies delivered an optimal development scenario of an average 60 000 tonnes per month underground mining operation using conventional mining in a bord-and-pillar configuration.

It is envisaged that three adits will be developed and six sections established in a phased ramp-up. The mining operation will be undertaken by a contractor with 70 % of the equipment fleet being provided by Acacia. ■

BFS positions Ngualla as a world-class development

The results of a Bankable Feasibility Study (BFS) on the Ngualla rare earth project (located in Tanzania) and proposed refinery in Tees Valley (located in the UK) have confirmed that the project has the potential to become one of the lowest cost and highest quality rare earth projects worldwide, says ASX-listed Peak Resources. The DFS was led by AMEC Foster Wheeler.

According to Peak, delivery of the project – in which it has 75 % ownership – is well timed to benefit from the expected strong uplift in the demand for permanent magnet motors required by the rapidly expanding electric vehicle market, which has been the main catalyst for significant increases in the price of lithium and cobalt since late 2015. Neodymium and praseodymium are expected to generate 90 % of Ngualla's future revenue.

The Ngualla deposit is located in Tanzania, 147 km from the city of Mbeya. It is one of the world's largest NdPr deposits, with a total mineral resource containing 4,6 Mt of REO (rare earth oxide). The deposit is host to a thick blanket of weathered, high-grade mineralisation from surface.

The project combines mining and multi-stage processing at Ngualla with downstream refining at a solvent extraction separation plant in the UK to produce a range of rare earth products.

The BFS estimates an operating cost of US$34,20 NdPr oxide, which Peak says demonstrates Ngualla's potential to be the world's lowest cost fully integrated rare earth development project, and a total pre-production capex (including the UK refinery) of US$356 million.

Peak has developed and demonstrated through extensive pilot plant operation a robust process for Ngualla's unique ore to provide confidence in the deliverability and operability of the three main processing stages – beneficiation, leach and purification/separation. The pilot plants together cost approximately A$5 million and comprehensively validate the operating and design parameters used in the study.

The annual output target is 2 420 tonnes of neodymium and praseodymium rare earth oxide (2N min 75 % Nd_2O_3); 530 tonnes of mixed samarium, europium and gadolinium rare earth carbonate; and 3 005 tonnes of cerium carbonate and 6 940 tonnes of lanthanum carbonate.

The study envisages production over a 30-year mine life based on the weathered Bastnaesite Zone mineralisation at Ngualla, which comprises only 22 % of the total Ngualla mineral resource estimate at a 1 % REO lower grade cut.

Mining at Ngualla will be by open-pit methods. As the mineralisation is weathered and at surface, mining will predominantly (70 %) be free dig requiring minimal blasting and with low ore to waste stripping ratios.

An optimal shell was selected as the basis for the open-pit mine design and subsequent LOM schedule, which is to be mined by four initial stages followed by the ultimate pit design. In line with previous studies, it is assumed mining is via two successive 2,5 m mining flitches.

Peak has designed a multi-stage processing plant that will be located on site at Ngualla to produce 28 300 t/a of rare earth concentrate grading 45 % REO. The plant comprises a ROM pad to receive mine production and blend plant feed to predefined specifications; a comminution circuit incorporating primary crushing, grinding and classification; and beneficiation of the ground feed utilising reverse gangue flotation, regrinding and rare earth flotation to produce a high grade/low mass concentrate. A segmented Tailings Storage Facility (TSF) will be used for safe disposal of waste solids and water reclaim.

"I would like to congratulate the Peak and AMEC Foster Wheeler teams and our other consultants on the delivery of a robust and comprehensive BFS," comments Peak's Managing Director, Darren Townsend.

"Our stakeholders can take comfort that the study has been completed under the leadership of our Chief Operating Officer, Rocky Smith and Technical Director, Dave Hammond, and is based on the Peak team's significant rare earth operating and marketing experience combined with extensive pilot planting." ■

A 3D perspective of the proposed processing plant at Ngualla.

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The Tschudi project is an open-pit, heap leach, SX/EW copper mine located near Tsumeb (photo: Weatherly).

Slow leaching hits Tschudi's first quarter production

Weatherly International, whose shares are quoted on AIM, reports that its Tschudi copper project in northern Namibia produced 3 236 tonnes of copper cathode in the March quarter. This was 24 % below nameplate capacity due to slower than anticipated leach rates for mixed oxide/sulphide ore stacked in the later months of 2016 and in early 2017. It says that it was unable to compensate for the shortfall due to above average seasonal rainfall during the quarter which prevented short-term acceleration of mining and stacking.

Mixed oxide/sulphide ore stacked earlier in 2016 had leached at rates as predicted in the 2012 Bankable Feasibility Study (BFS). However mixed ore stacked later in 2016 showed slower leaching characteristics over time, leading to the current production shortfalls.

Investigations are continuing with appropriate external assistance and advice to determine how site operating parameters may be changed to ensure that optimal conditions for bacterial leaching of sulphide minerals are maintained in the heap in order to maximise leach rates and ultimate overall recoveries of copper from stacked ore.

The changes currently under investigation include changes to solution chemistry, potential for forced aeration of the heap, modified irrigation strategies, and possible changes to lift heights.

In the meantime, capital construction of the stage two heap leach pad area has commenced to provide additional time for the leaching of copper from mixed ore currently under irrigation, and also for implementation of changed operating parameters for this ore prior to sealing and over-stacking.

Groundwater in the open pits had no adverse effect on mining during the quarter, with groundwater inflows managed using the in-pit pumping systems. Detailed investigations continue into opportunities to reduce operating costs and production delay risks via capital expenditure to enable removal of groundwater before it enters the pits.

During April, says Weatherly, rates of stacking contained copper metal tonnes onto the heap have improved and the rate of leaching copper metal tonnes into solution is expected to improve during the June quarter. However April's cathode production tonnage will remain weak.

Full financial year production to June 2017, as previously advised by Weatherly, is now forecast to be 14 500 to 15 000 tonnes.

The poor production result in the March quarter has caused C1 quarterly operating costs to increase to US$5 907/t. Full financial year C1 costs are now forecast to be US$5 250 to US$5 350 per tonne. ■

Nkuluwisi adds to the potential of New Luika

Shanta Gold, listed on AIM, has provided an update from its ongoing exploration programme within, and surrounding, the New Luika Gold Mine (NLGM), located in the Lupa goldfield of south-west Tanzania.

In March this year, Shanta released encouraging drilling results from the Nkuluwisi mineralised target, located approximately 12 km north-west of the NLGM's central processing hub. Since March, the company and its independent resource consultants have worked to produce a JORC-compliant Code (2012) maiden resource for Nkuluwisi.

Total resources declared for Nkuluwisi amount to 3,97 Mt at 1,1 g/t for 140 894 ounces of gold. The measured resources total 224 000 t at 1,29 g/t for 9 266 oz of gold while the indicated resources total 2,3 Mt at 1,13 g/t for 83 888 oz of gold. In addition, the deposit has inferred resources of 1,44 Mt at 1,03 g/t for 47 761 oz of gold.

Toby Bradbury, Shanta's CEO, commented: "The significant scale of Nkuluwisi opens the door to possible expansion options at our flagship New Luika Gold Mine to target lower grade orebodies which could increase production levels and add to mine life. The NLGM already has resources of 9,47 million tonnes at 2,24 g/t for 683 000 oz that sit outside the recently updated Revised Mine Plan and the Nkuluwisi maiden resource adds significantly to that. Further upside remains along strike at Nkuluwisi and also at a series of highly prospective and proximate targets in the Lupa goldfield identified through our focused exploration programme." ■

Underground project at Syama ahead of schedule

Development of the new underground mine operation at the Syama gold mine in Mali is running ahead of schedule, says ASX-listed Resolute Mining in its report for the March quarter of 2017.

Surface excavation of the boxcut commenced during the quarter and is expected to be completed during the December quarter 2017. Mine development has commenced on the first production level (1130 Level) of the underground mine. The underground excavation also advanced on the incline and decline. Development of the 1130 Level Access began and geological sampling commenced with some low grade ore identified and mined.

Resolute says it continues to investigate technology and innovation enhancements that have the potential to increase the efficiency and productivity of the Syama underground mine. Equipment manufacturers have been engaged to give advice on mine design improvements to capture the latest underground mining technology with a focus on automation. The Syama underground conveyor study continues to assess the viability of underground crushing and conveying in comparison with the current dual decline truck haulage system.

Syama is located in the south of Mali, approximately 30 km from the Côte d'Ivoire border and 300 km south-east of the capital Bamako. ■

Syama open pit with main decline boxcut being developed on right of picture (photo: Resolute Mining).

The Liqhobong processing plant seen from the south (photo: Firestone).

Final ramp-up at Liqhobong on track

In its report on the quarter ended 31 March 2017, Firestone Diamonds plc, the AIM-quoted diamond company, reports that commissioning activities at its new Liqhobong mine in Lesotho are largely complete and that the final ramp up is progressing on track

During the reporting period, 639 000 tonnes were treated with nameplate capacity continuing to be achieved on numerous occasions. Some 103 000 carats were recovered at a grade of 16,1 carats per hundred tonnes (cpht), compared to 58 000 carats at a grade of 14,1 cpht in the previous quarter.

Over the three months, Firestone continued to calibrate the processing plant with scheduled shut downs as part of the normal commissioning activities. The modifications implemented were primarily designed to address the low carat recoveries experienced in the previous quarter. While these modifications impacted on the volume of tonnes treated, and in turn carats recovered, they have proven to be effective with the grade rising to 20,1 cpht at the end of March.

In addition, the diamonds are being recovered with less than 1 % measured diamond damage, which Firestone views as extremely positive.

The waste stripping is on schedule and Firestone is in the process of dewatering the south-eastern side of the main pit to begin accessing better quality ore later in the current quarter.

The project maintained its outstanding health and safety record, having reached 4 million man hours worked without a single Lost Time Injury (LTI) at the end of March.

During the period, Firestone held two diamond sales (in February and March) in Antwerp. All 127 590 carats on offer were sold and achieved an average price of US$107 per carat for total proceeds of US$13,7 million.

"It is pleasing to see that the improvements and modifications made to the plant during commissioning have improved performance," comments Stuart Brown, Firestone's CEO. "During the quarter, we have seen a steady improvement in the grade with our daily recovery exceeding 20 cpht at the end of March following the implemented modifications. 103 000 carats were recovered in the quarter including 31 special stones larger than 10,8 carats and, post the period, we were delighted to recover our first plus 100-carat stone.

"The final commissioning phase has seen the mine achieve nameplate capacity on numerous occasions which is very positive, particularly during the rainy season."

Paradigm to undertake FEED study for Tongo-Tonguma

Further to its announcement on 28 April 2017 that it had entered into a Tribute Mining Agreement with Octea Mining in relation to the Tongo-Tonguma kimberlite dyke diamond project in Sierra Leone, Stellar Diamonds reports it has now entered into a contract for the Front End Engineering and Design (FEED) study to be conducted for the underground mine development of the project. South Africa's Paradigm Project Management (PPM) has been appointed to prepare the study.

The project is reported to be one of the highest dollar per tonne value kimberlites in Africa and has the potential to be the second largest diamond mine in West Africa.

"The FEED is a very important first step in the mine development process," comments Karl Smithson, Chief Executive of AIM-listed Stellar. "PPM are highly experienced in the delivery of diamond mine projects and, together with SRK Consulting, they will refine all elements of the mine plan as determined in the PEA to higher levels of confidence in order to reduce the project delivery risk.

"With over 66 000 m of drilling completed at the project to date, we will undertake mine plan related drilling to a depth of 75 m concurrent with the FEED study.

"Once work commences on the FEED, it is expected to take approximately four months to deliver (including drilling) and will mark the onset of the mine development programme. I look forward to updating shareholders on our progress as we work to transform Stellar into a long term, high value diamond producer."

PFS confirms Mahenge's long-life, low-capex potential

Tanzanian graphite developer Black Rock Mining, listed on the ASX, has completed the Preliminary Feasibility Study (PFS) for its 100 %-owned Mahenge graphite project. The company says the study confirms Mahenge's outstanding potential as a long-life, low-capex, high-margin operation.

The PFS is based on mining and milling 61,1 Mt of resource and reserve at an average grade of 8,9 % Total Graphitic Contained (TGC) for a life of mine (LoM) production of 5,1 Mt of concentrate. The LoM strip ratio is exceptionally low, at 0,8 to 1, benefiting from an even distribution of mining material at high grades through both pits.

Metallurgical test work indicates the concentrate will have commercially desirable product size and purity attributes. The mine plan is also advantaged by bulking in all mineralisation above cut-off grade resulting in limited need for costly selective mining methods.

Pre-production capex is estimated at US$90,1 million with total capex estimated at US$159 million including Stage 2 and a 15 % contingency. Key financial metrics include a post-tax, unlevered, IRR of 48,7 % and an NPV using a discount rate of 10 % of US$624 million.

Mining will be by owner-operator using conventional open-cut mining techniques. The mining strategy is to mine out the lower strip ratio Ulanzi deposit, followed by the Cascade deposit commencing in year 13. Processing will be by well-proven crushing, grinding and flotation methods.

"The PFS builds on a compelling scoping study and reconfirms the Mahenge graphite project's potential to be a globally significant graphite producer, with industry leading low capex, and sustained high margins," says Black Rock's Interim CEO and Executive Director, John de Vries. "The mine metrics are driven by low strip ratios and high grade ore that can be relatively simply converted into large high purity, premium flake concentrates.

"Mahenge is financeable with a unique combination of ultra-low pre-preproduction capex, sustained bottom quartile operating costs and a premium high purity large flake product that – as an investment – is simply not available in any other projects.

"Our staged development model of two 83 kt per annum modules is unique in our sector. The approach is to be large enough to be investable but small enough not to disrupt the overall flake market, while generating sufficient cash to self-fund the second module. The self-funding, sequential module strategy is sized to accommodate the expanding market in high purity flake without being overly disruptive. It simplifies and de-risks our build by utilising modular assembly and flat-pack, off-site construction where possible.

"We are now completing negotiations with DFS and construction partners and expect to commence work quickly on optimising the PFS and commencing detailed engineering with a view to commencing construction in 2018." ■

XRT technology ushers in a new

The spectacular success of TOMRA X-ray transmission (XRT) technology at the Karowe diamond mine of TSX-listed Lucara Diamond Corp in Botswana has led to more and more diamond mines electing to install TOMRA's sorters in their processing facilities. The XRT technology provides a single-stage alternative to traditional concentration and recovery techniques used in the diamond mining industry and is particularly effective in preventing the breakage of large diamonds during processing operations, a problem which has bedevilled the industry for years.

Although XRT technology goes back several decades in applications such as recycling, its use in the diamond mining industry is much more recent with TOMRA Sorting Mining, the mining arm of TOMRA's Sorting Division, having only started development of its machines for diamond recovery in 2005. A pilot XRT unit was installed at Gem Diamonds' Letšeng mine in Lesotho in 2011, where it worked successfully for several months. The breakthrough, however, was the installation of the technology at Karowe in 2015.

TOMRA's XRT machines at Karowe were commissioned in April 2015 as part of a major plant upgrade designed to address the changing characteristics of the orebody as open-pit

The TOMRA XRT machines installed at Karowe (photo: Lucara).

era in diamond recovery

A view of Lucara's Karowe mine in the Orapa Kimberlite Field of Botswana. The tall building in the centre of the photo houses the XRT sorters (photo: Lucara).

Below: *TOMRA and Karowe personnel in the XRT section of the Karowe processing plant (photo: Lucara).*

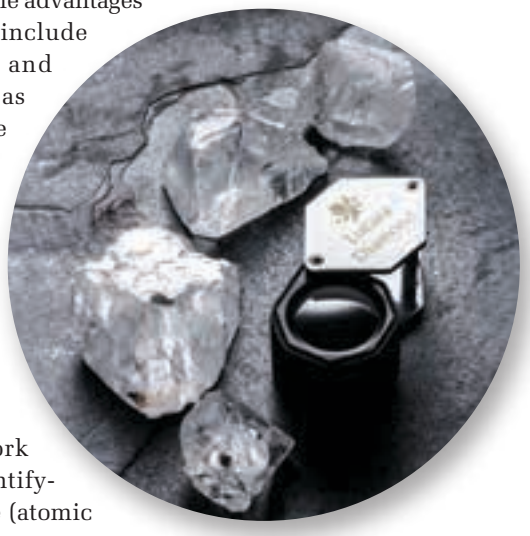
mining progressed, most notably the increasing density of the material at depth which was resulting in a higher DMS yield to the recovery plant. The upgrade also provided the opportunity to install a large diamond recovery circuit, a priority for Lucara given that Karowe – which mines the AK6 kimberlite – was proving to be a far bigger producer of large, high value diamonds than was originally anticipated.

"After extensive test work which saw several tons of Karowe ore being shipped to TOMRA's facilities in Germany, we were able to demonstrate to Lucara that the use of our XRT technology would deliver a significantly lower percentage yield in a single pass in the plus 8 mm fractions and proved that it was possible to replace both DMS and Final Recovery with a single stage, at the same time also providing 100 % detection of every diamond in the feed," says Geoffrey Madderson, Diamond Segment Manager at TOMRA Sorting Mining. "As a result, we were awarded a contract to install six of our COM Series XRT | D belt sorters at Karowe to replace DMS technology in the +8 mm size range, with each unit able to treat up to 150 tons per hour (tph) at over 8 000 hours per year."

The XRT machines installed deal with three size fractions. The largest size fraction is processed through a Large Diamond Recovery (LDR) XRT machine, able to recover diamonds in excess of 1 000 carats. The +14-32 mm fraction is processed through two coarse XRT machines, and the finer +8-14 mm fraction is processed through two middles XRT machines. The sixth machine is used in an audit role.

All XRT concentrate is directed to a high security 'Red Area' directly below the XRT machines, and into separate, individual sorting glove boxes, where hand sorting takes place.

Some of the large diamonds recovered by the XRT sorters at Karowe (photo: Lucara).



Madderson says that the advantages of the XRT technology include its compact footprint and lower operating costs, as well as the fact that there is no need to further process the concentrate from the sorters before final hand sorting. Capacities are impressive with the latest generation units being capable of handling up to 420 tph.

The XRT sorters work on the principle of identifying the carbon signature (atomic

The Renard mine of Stornaway in Quebec, Canada, is the first diamond mine in the world with LDR in its primary flowsheet (photo: Stornaway).

number) of diamonds. They reliably detect all diamonds including coated, low luminescent and Type II diamonds which can prove problematic for other recovery methods and they greatly reduce the incidence of diamond breakage as they minimise the exposure of diamond-bearing ore to comminution processes which can result in diamonds being damaged.

The XRT machines at Karowe have proved to be a huge success, the high point being a single week in November 2015 which saw the recovery (in the LDR unit) of the second biggest diamond ever to be unearthed by a diamond-mining operation, the 1 109-carat *Lesedi la Rona*, as well as the 813-carat *Constellation*. The *Lesedi la Rona* is still in Lucara's possession but the company announced in May last year that the *Constellation* had been sold for US$63 million, a new record for a rough gem.

Following on from the initial installation, Lucara is now in the process of more than doubling the number of TOMRA XRT sorters at Karowe, with three separate projects currently underway and due for commissioning later this year. The first is the Mega Diamond Recovery (MDR) facility, which is being installed post the primary crusher and which will allow diamonds up to several thousand carats to be recovered. The second is a sub-middles XRT project. This is targeting the recovery of diamonds between 4 mm and 8 mm and will enable the scale of high-cost DMS operations at Karowe to be further reduced. The third project will see a further two units being installed to audit material between 4 mm and 20 mm.

"The success of our technology at Karowe has led to huge interest from other diamond miners and indeed a surge in sales," comments Madderson. "The amazing outcome we've had at Karowe is due to the confluence of a number of factors, including a dynamic client receptive to the introduction of new technology, as well as the characteristics of the orebody, most notably the high yielding ore, the very coarse size/frequency distribution and the presence of a very significant population of large, high value diamonds in the AK6 kimberlite."

The applications of TOMRA's XRT technology are not confined to kimberlite material and the sorters have proved very effective in alluvial operations, a case in point being the Lulo mine in Angola operated by ASX-listed Lucapa Diamonds. A single TOMRA machine was installed there in the final quarter of last year. Forming part of a new coarse recovery stream, it processes material between 18 and 55 mm in size and allows the recovery of individual diamonds of up to 1 100 carats. It has already proved its worth with Lucapa announcing in February this year that it had been responsible for the recovery of a 227-carat stone, Angola's second biggest diamond on record.

"The recovery of the 227-carat diamond through the new XRT circuit … vindicates our investment in this large-diamond recovery technology, which will have more than paid for itself with the recovery of this one stone alone," commented Stephen Wetherall, Lucapa's MD, at the time of the announcement.

Elsewhere in Africa, two TOMRA XRT machines have been delivered to the Kao mine of Storm Mountain Diamonds in Lesotho, one is currently being installed at Letšeng, while a further two have been supplied to an alluvial operation in Sierra Leone.

Outside of Africa, the technology has been selected for Lipari's Braúna mine in Brazil, reputedly the first kimberlite mine in South America, and for two Canadian kimberlite projects. One is the newly commissioned Renard mine of TSX-listed Stornaway in Quebec, which is the first diamond mine in the world with LDR in its primary flowsheet (treating +19 mm-45 mm material), while the second is the Star-Orion South project in Saskatchewan of Shore Gold, also listed on the TSX.

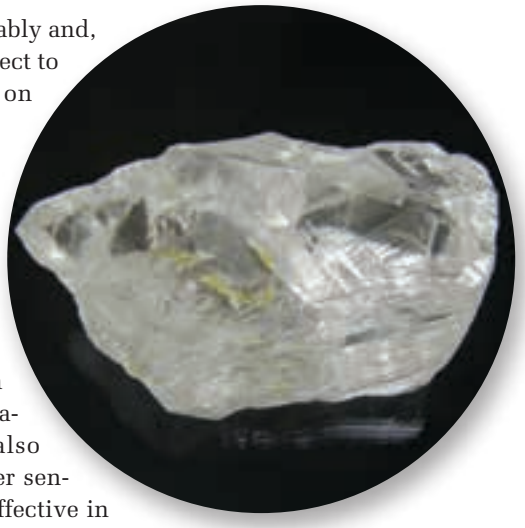
In a recent update on Star-Orion, Shore Gold reported that some 2,8 tonnes of AG milled product had been shipped to TOMRA in Germany for diamond recovery testwork using the TOMRA dual energy X-ray transmission (DEXRT) full-scale sorter. "The results of the test showed that XRT is viable as a replacement, for +8 mm fractions, for dense media separation in the re-design of the process plant,

potentially reducing capital costs of the plant, and simplifying the overall flowsheet, leading to reduced operating costs and a smaller environmental footprint," says Shore in its update. "TOMRA engineers are currently developing XRT sorters for use in final recovery, with a proposed capability of recovering diamonds down to +2 mm from DMS concentrate."

Madderson stresses that TOMRA Sorting Mining is not simply a supplier of equipment. "Every system we install – although it is based on our standard sorters – is designed around the needs of the customer with the aim of providing a customised process solution that is consistent with the characteristics of the ore to be treated and the operational requirements of the project or mine," he says. "We are always closely involved with the commissioning of our machines and, beyond that, we can assist with their ongoing operation. We have a full service agreement in place with Karowe, for example, which ensures that the XRT machines are kept in peak condition and run reliably and, by the end of this year, we expect to have 20 full-time employees on the mine.

"So, to sum up, we see ourselves as a solutions provider to the mining industry dedicated to partnering with our customers to provide them with the ability to extract maximum value from their orebodies. XRT is the main thrust of our offering in the diamond mining field but we also have available a range of other sensors which can also be very effective in concentration and final recovery. Using these technologies and, in particular XRT, mines now have a very viable alternative to the conventional systems that have traditionally been used to process diamond-bearing ores."

Report by Arthur Tassell



The 227-carat diamond recovered by a TOMRA XRT sorter at Lucapa's Lulo mine in Angola (photo: Lucapa Diamonds).

TOMRA celebrates 45 years in business

TOMRA, which is celebrating its 45th anniversary this year, was started in a small shed in Asker, Norway, by two brothers, Petter and Tore Planke, who had developed – at the request of a local grocer – an automated machine that could quickly and easily take back used, empty bottles for recycling.

Today the company is a diversified group which in 2015 had revenues of Euro 650 million. It is headquartered in Norway and is listed on the Oslo Stock Exchange but has operations around the world, including factories located in Slovakia, the USA, The Netherlands, Germany and Belgium. The company reinvests 8 % of its revenues in research and development and around 20 % of its 2 600-strong global workforce is engaged in R&D.

TOMRA operates in two business areas – Collection Solutions (reverse vending and material recovery) and Sorting Solutions (recycling, food sorting and mining). Mining is the smallest part of its Sorting Solutions division but is regarded as having high potential.

Although our article here has focused on TOMRA's XRT sorters, the company offers a full mining sensor portfolio comprising electromagnetic, near-infrared spectrometry (NIR), colour and laser reflection/fluorescence sensors.

TOMRA's mining business is headquartered in Hamburg, Germany, but the South African subsidiary has played a lead role in driving its expansion into mining and in developing the XRT technology. ■

Gakara rare earth project

Rainbow Rare Earths, now listed on the LSE after a US$8 million fund-raising and successful IPO in January this year, is moving swiftly to bring its Gakara rare earth project in Burundi into production. Extraction of run-of-mine ore has started on site and an EPCM contract has been signed for the processing plant. The ore will be stockpiled until the plant becomes operational later this year. ***Modern Mining's*** *Arthur Tassell recently spoke to Rainbow's CEO, Martin Eales, to learn more about the project.*

Martin Eales, CEO of Rainbow Rare Earths.

Gakara is unusual on several counts. It ranks as one of the highest grade rare earth deposits in the world, the capex to get it up and running is incredibly low (at just US$2,23 million) and, once in production, it will be the only formal sector mine in Burundi (although the country does have some small scale gold, tungsten and coltan artisanal operations). Moreover, it will rank as one of the few producers of rare earths outside of China, which currently accounts for an estimated 90 % of world production.

According to Eales, the low capex reflects the phenomenally high grade of Gakara. "The estimated in-situ grade is in the range of 47 to 67 % total rare earth oxides (TREOs), with the average over the entire deposit being 57 %," he says. "To put this in perspective, most other deposits around the world are in the region of 3 to 5 %. This means that for a specific level

Work underway at the initial mining area at Gasagwe allowing stockpiling of ore prior to process plant commissioning later this year.

on fast track to production

of production, we only have to mine and treat a fraction of the tonnages that other projects would require to get to the same point."

The deposit also lends itself to very simple, straightforward mining. "In our first mining area, Gasagwe, we'll be manual bench mining in 1 m 'steps' to expose the veins in which the mineralisation is contained. The need for mechanised equipment is minimal and in fact the entire cost of our mining fleet – essentially just some TLBs and a tractor-trailer – is budgeted at less than US$600 000. The mining will only take place from the outcrops at surface to a depth of about 30 to 50 m and no drilling and blasting will be required," says Eales.

He adds that the second deposit to be mined – Gashirwe West – will require underground extraction. "Here again, though, the proposed method is very simple – essentially it will involve the use of up-dip, room-and-pillar manual mining with access to the mining areas being provided by relatively short hand-dug adits driven into the hillsides. No expensive infrastructure such as shafts is needed."

The Gakara project is located in hilly terrain in Western Burundi and is roughly a 90-minute drive from the capital city, Bujumbura. The mineralisation at the site was discovered in the 1930s during the Belgian colonial era and a mine was established in 1948 which produced intermittently from a number of deposits through to 1978 when a decline in rare earth element (REE) prices rendered operations uneconomic. Most of the mining over this period was by open-pit methods although some underground mining was undertaken.

"The total production was modest by modern standards, with only around 5 000 tonnes of vein material being extracted over 30 years," states Eales. "We're aiming to produce roughly 5 000 tonnes a year – and ultimately twice this figure."

An interesting point is that Gakara will be producing a high-grade concentrate rather than

View of the Gasagwe mining area. The trial mining phase will see 3 338 tonnes of ore being produced from Gasagwe.

Gravity surveying in the project area.

The project area is characterised by rugged terrain with incised drainage, intense cultivation and thick weathering profiles.

finished REO (rare earth oxide) products. While the market for rare earth concentrates is quite small, Rainbow already has in place a 10-year distribution and offtake agreement for exclusive sales of up to 5 000 tonnes per annum of concentrate with thyssenkrupp Raw Materials, an active worldwide metals trader with offices in Europe, North America, South America and China. The concentrate will be transported by road from Gakara to either Dar es Salaam in Tanzania or Mombasa in Kenya for shipping to overseas customers.

Rainbow has been involved with Gakara since 2011 (which is the date when the company was established). Recounting the background, Eales says that the deposit – which had lain fallow since the cessation of mining in 1978 – came to the attention of mining entrepreneur Adonis Pouroulis (who founded Petra Diamonds 20 years ago) in 2009 when he met up with a Burundian geologist in Angola while visiting one of Petra's properties in the country. Pouroulis followed up on this information and a team from what would later be Rainbow visited the site in 2010 and also examined the historical records (most of them archived in Belgium). An application for an exploration licence was subsequently submitted and granted in 2011.

Pouroulis remains closely involved with Rainbow (he is non-executive chairman) and Rainbow, in fact, forms part of his Pella Resources group, which has several African mining and energy projects in its portfolio.

Subsequent to being granted an exploration licence for Gakara, Rainbow carried out an extensive exploration programme including pitting and trenching, geological mapping, rock grab sampling, ground gravity and magnetic surveys and detailed geochemical sampling. Its work on site has also encompassed a bench mining exercise conducted in 2015, as well as the collection of a sample of REE vein material for mineralogical and metallurgical testwork. In addition, a conceptual mine study was completed in 2016. In all, Rainbow expended US$4,8 million on the project between 2011 and 2016.

The main objective of the geological mapping was to locate in-situ REE veins and by April 2013 nearly 800 occurrences of high-grade vein material had been identified in the project area, with 387 of these occurrences being established as in-situ veins (the balance being transported material). "This was more than enough to justify an application for a mining licence and this was awarded to Rainbow in 2015," says Eales.

Although Gakara is now entering the mining phase, the project has no defined mineral resource. "What we have is an exploration target of 20 000 to 80 000 tonnes of vein material," notes Eales. "As you know, this is a defined classification within the JORC code. The problem with trying to produce a defined resource is that the nature of the deposit is such that it would require – and this is the view of our Competent Person, the MSA Group – a very large amount of closely-spaced drilling to be undertaken at considerable cost. We don't believe this is necessary, as we can see where we need to mine and are confident that we have the tonnages and grade to underpin a commercially viable mining operation."

He adds that the initial mining phase at Gakara is technically a trial mining programme, as recommended by MSA. "Having said this, we will, from the first day, be operating on a commercial basis and we envisage a seamless transition from the trial mining programme into full production."

The trial mining phase is expected to last 22 months, with planned production of 3 338 tonnes of ore for 2 503 tonnes of concentrate from the Gasagwe site and 1 933 tonnes of ore for 1 379 tonnes of concentrate from the Gashirwe West site. Mining starts at Gasagwe

with Gashirwe starting up in month 13. Assuming successful completion of the trial mining phase, Rainbow intends ramping up production to 5 000 t/a (420 tonnes per month) of concentrate.

The process flowsheet for the beneficiation plant is based on physical gravity separation only (there is no need for hazardous chemicals) and will see the ROM ore being subjected to crushing, screening, jigging and shaking table processes to produce concentrate. The plant will have a capacity of 10 t/h but be capable of ramping up to 5 000 t/a. Rainbow has recently awarded the EPCM contract for the design, supply and construction of the plant to Obsideo Consulting of South Africa with the agreed commissioning date being in the fourth quarter of this year.

As this article was being written, preparation for mining at the first production site, Gasagwe, was well advanced with the construction of haulage and access roads, as well as basic infrastructure, in progress and a locally recruited labour force in place and ready to start on the extraction of ROM ore from the high grade veins.

To implement the project, Rainbow has assembled a strong team which includes Braam Jankowitz as Project Manager, Gilbert Midende as General Manager, Cesare Morelli as Technical Director and Joël Ntungwanayo as Chief Geologist.

Jankowitz is a geologist (he has an MSc Geology) but is also well versed in mine management having served, prior to joining Rainbow, as GM of the New Luika gold mine in Tanzania while Midende has a doctorate in geology and has served as the Burundi Director of Geology and Mines and also as Burundi's Minister of Mines. Morelli, also a geologist, was previously Minerals Exploration Manager for Africa with BHP Billiton while Ntungwanayo has a background with BHP Billiton and the Burundi Geological Survey.

Rainbow enjoys strong support from the Government of Burundi, which is keen to establish a formal mining industry in the country and which has a 10 % free carry in the project, and from local communities. While the mine will be relatively small in scale, the manual mining methods to be employed mean that the workforce may eventually number in the region of 200 people – a welcome number of job opportunities in an area where most people depend on subsistence farming for their livelihoods.

A strength of the project is that the Gakara 'basket' is weighted heavily towards the magnet rare earths, including neodymium and praseodymium which now account for 70 % of annual global REE sales due to their use in equipment such as motors, generators, wind turbines and electric vehicles. Many commentators are predicting strong growth in demand for rare earths over the coming decade, with some seeing prices quadrupling by 2025.

A typical example of ore from the Gakara project.

According to Rainbow, the contained value of Gakara concentrate samples (on a separated basis) is in the region of US$6 000/tonne as against operating costs – in the first year – of US$810/tonne and transport, marketing and royalty costs of US$280/tonne.

Gakara will almost certainly be the first of the current crop of African rare earth projects to enter operation. Most, if not all, of the others are burdened by huge capex costs (although they are many times larger in scale than Gakara) and appear to be years rather than months away from production. To give examples of the capital expenditures required, the just released BFS on the Ngualla project of Peak Resources in Tanzania estimates the capex at US$356 million (which includes a refinery in the UK) while the 2015 PFS on the Zandkopsdrift project of Frontier Rare Earths in South Africa estimated a capex of more than half a billion dollars just for the first phase of development.

As Eales says, "Gakara is a niche project which can't really be compared with anything else. The combination of high grade and a tiny capex make it unique. Although we're not in a race with anyone else to be first to market, it does indeed look as though we will be the first of the African projects currently under development to enter production. We have a clear road ahead and are confident that we will achieve first sales of concentrate by the end of this year."

Photos courtesy of Rainbow Rare Earths

Rainbow enjoys strong support from the Government of Burundi, which is keen to establish a formal mining industry in the country.

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Newmont to expand Ahafo

Newmont Mining Corporation, listed on the NYSE, has announced plans to extend profitable production at its Ahafo operations in Ghana by building a new underground mine and expanding plant capacity by more than 50 per cent.

Processing facilities at Newmont's Ahafo gold mine in Ghana (photo: Business Wire).

The Subika Underground mine is expected to produce 1,8 million ounces of gold over an 11-year mine life and features ore grades of 4,7 g/t. The mill expansion is expected to improve margins and support profitable production at Ahafo through at least 2029.

"We are building on strong performance and solid infrastructure by investing in the next generation of profitable production at Ahafo," said Gary Goldberg, Newmont's President and CEO. "The Subika Underground mine will also create a platform to support even longer-term growth. Recent exploration results demonstrate considerable upside within the Subika deposit and adjacent Apensu Deeps deposit."

The projects have been optimised to improve internal rates of return to more than 20 per cent at a US$1 200 gold price. In the first five full years of production – or from 2020 through 2024 – they are forecast to add incremental gold production of between 200 000 and 300 000 ounces per year at Ahafo for total average annual production of 550 000 to 650 000 ounces. The projects are also expected to lower unit costs during the same time frame.

Costs applicable to sales (CAS) are expected to decrease by between U$150 and US$250 per ounce compared to 2016 for total average CAS of US$650 to US$750 per ounce. All-in sustaining costs (AISC) are expected to decrease by between US$250 and US$350 per ounce compared to 2016 for a total average AISC of US$800 to US$900 per ounce.

Newmont received its environmental permit to build and operate the Subika Underground mine in March 2017. The resource has been studied for 11 years and execution and technical risks are well understood. The company expects to reach first production at the mine in the second half of 2017 and commercial production in the second half of 2018.

African Underground Mining Services (AUMS), a 50:50 joint venture between ASX-listed Ausdrill and Barminco Holdings, has been appointed to undertake the Subika Underground mining contract.

The contract has a five-year term and encompasses the supply of all underground mining services for the Subika Underground mine, including development and production activities, diamond drilling and associated services. The estimated value is US$280 million.

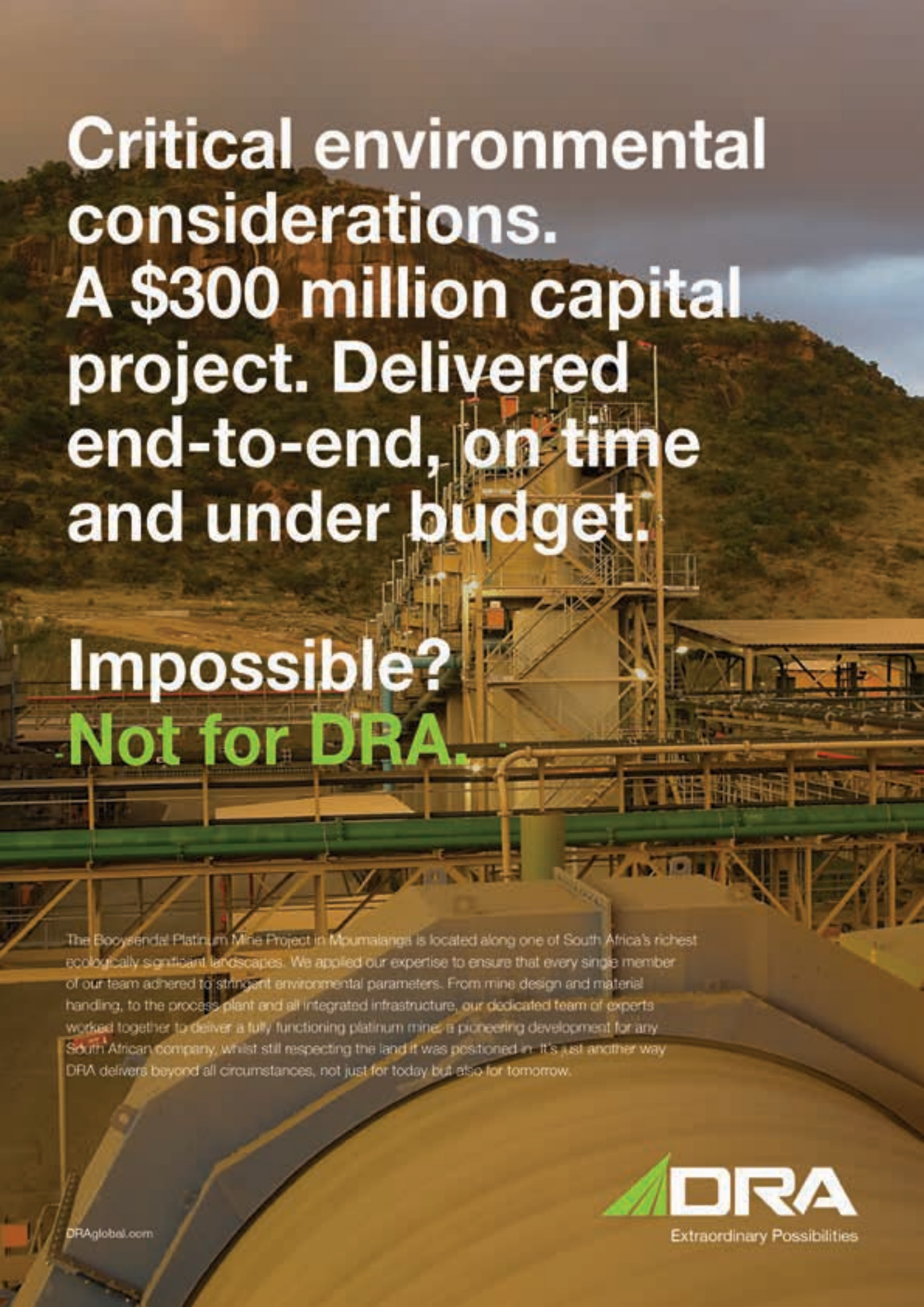
The Ahafo mill expansion will increase annual mill capacity by 50 per cent to nearly 10 million tonnes by adding a crusher, grinding mill and leach tanks to the circuit. The expansion supports more efficient processing of harder, lower grade ore from existing surface mines, as well as Ahafo's stockpiles and the Subika Underground mine. Newmont expects first gold production at the mill expansion in the first half of 2019 and commercial production in the second half of 2019.

Development capital of between US$300 million and US$380 million will be funded through free cash flow and available cash balances. Newmont will uphold local hiring and procurement commitments and existing bargaining agreements through construction and operation.

Commercial production at Ahafo – located in the Brong Ahafo region, approximately 307 km north-west of Accra – began in 2006 and the operation achieved 5 Moz of gold production in October 2016. Three surface mines – Subika, Awonsu and Amoma – feed a conventional mill with a carbon-in-leach circuit. A fourth surface mine, Apensu, is currently being used for water storage.

Newmont also owns and operates the Akyem mine in Ghana. Located in the Birim North District of the Eastern Region, approximately 177 km north-west of Accra, Akyem has been in commercial production since 2013 and produced just over 400 000 ounces of gold in 2016. ■

The resource has been studied for 11 years and execution and technical risks are well understood.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Tharisa signs deal on MCC mining fleet

Open-pit operations by MCC at the Tharisa mine. Tharisa is acquiring 170 machines from MCC and is shifting to an owner mining model (photo: Tharisa).

Tharisa, the profitable low cost producer of PGMs and chrome, has signed an agreement with MCC Contracts Proprietary Limited (MCC) to acquire 170 'yellow fleet' machines and site infrastructure, including excavators, dump trucks and support vehicles, and transfer approximately 900 employees from MCC.

The purchase consideration is R303,3 million less the deduction of certain liabilities relating to the transfer of employees such as the leave pay provision and the deduction of future costs that have been incorporated into the mining rate to date, such as future equipment mobilisation.

This will be settled through a cash payment of R250,0 million with the balance owing being paid in cash in six equal monthly instalments. Tharisa has also agreed to take over lease agreements for 14 machines.

Tharisa, in the normal course of managing its mining operations, has developed engineering and geological skills that are integral to in-house mining, and the transfer of the skilled on-site employees of MCC in their existing roles will ensure that the Tharisa mine transitions to an owner mining model without interruption.

With a long life of the open pit of 18 years, Tharisa believes the transition to an owner mining model is a logical progression in its development. The change in the operating model is expected to have both cost and operational benefits as well as providing financial flexibility, thereby cementing Tharisa's low-cost, high margin position.

"MCC has provided contract services to Tharisa Minerals since its inception and we thank the company and team for its contribution to our growth. We are excited by the opportunity to transition to owner mining, which will afford us further operational and cost efficiencies," comments Tharisa CEO Phoevos Pouroulis.

The Tharisa mine is located on the south-western limb of the Bushveld Complex, approximately 95 km north-west of Johannesburg and 35 km east of Rustenburg. ■

Top-of-the-range Volvo machines

Volvo Construction Equipment's much-anticipated 60-ton A60H articulated dump truck and 90-tonne EC950E crawler excavator, the biggest articulated dump truck in the world and the largest excavator that Volvo has ever produced respectively, were officially launched in South Africa in early May at Babcock's state-of-the-art Middelburg facility.

More than 100 customers – some from as far afield as Zambia, Zimbabwe and Mozambique – were on hand to witness the introduction of the machines. The guests were addressed by Roger O'Callaghan, CEO of Babcock International Group's African operations, and David Vaughan, Managing Director of Babcock's equipment business.

This is the first time that the two machines will be available for purchase in South Africa following their unveiling at the Bauma exhibition in Germany last year. The A60H and EC950E are available in Southern Africa through Babcock, the sole regional distributor of Volvo Construction Equipment in the region.

Vaughan says that Babcock is fully prepared for the roll-out of the A60H and EC950E. Volvo teams from Sweden and Korea have completed intensive sales and technical training with Babcock staff in South Africa, while Babcock has ensured that there is sufficient availability of Volvo spare parts and other related elements such as the larger specialised tyres that the A60H utilises.

He adds that Babcock has partnered with local vendors to develop solutions for the aftermarket for both machines such as fire suppression, automatic greasing and collision avoidance systems.

In preparation for the roll-out, Babcock has been appointed as an accredited Allison transmission service dealer to be able to undertake

Centre: *The brand new A60H (on the left) pictured with the established A40G hauler.*

Below: *Visitors at the launch view the two new machines (with the third machine on display at the far left being a Volvo A40G hauler).*

launched by Babcock

repairs and servicing of the fully automatic Allison transmissions that form part of the backbone of the A60H dump truck.

Vaughan says that six A60H dump trucks have been ordered by South African customers while first orders for the EC950E crawler excavator have also been placed. One of the South African customers is Burgh Plant Hire, which placed its order for three A60Hs and one EC950E at last year's bauma show. Its new machines, which are now in the process of being delivered, will mainly work in the Highveld coalfields.

"The A60H and EC950E are eminently suitable for local mining operations as their robust drivelines are designed specifically for challenging applications such as those found in the Southern African mining environment," says Vaughan. "The A60H articulated dump truck in particular is perfectly suited for opencast coal mining where short yet extremely steep ramps have to be climbed to access boxcuts made through overburden in order to expose high grade coal."

The A60H can move more tonnes per hour and gives 100 % in all conditions. The largest true articulated hauler on the market, it has a bigger payload (55 metric tons or 61 short tons) for heavy-duty applications, delivering up to 40 % more productivity than Volvo's previous largest hauler. The Volvo A60H embodies the full articulated hauler concept and provides total versatility so that the entire jobsite can be accessed and steeper gradients climbed.

It works in all seasons, terrains and applications using tailored machine configurations and tyres that have been optimised for the machine. Goodyear, Bridgestone and Michelin will manufacture the specialised tyres required for the A60H.

The A60H has several features that will be familiar to current series A40 operators, eliminating the need for major retraining of operators. Operators will only require a short orientation course and technicians who regularly service other Volvo dump trucks will have knowledge of many of its elements.

Designed to load the A60H, the other new machine on display in Middelburg, the 90-tonne EC950E, is Volvo's largest ever crawler excavator. It is claimed to deliver best-in-class fuel efficiency and features a powerful 16-litre engine, a new electro-hydraulic control system, Volvo's unique ECO mode and an ergonomic operator environment.

With over 424 kN of breakout force and 408 kN of tearout force, Babcock says the EC950E offers the perfect combination of power and stability. It features a wide track gauge, long track length, a retractable undercarriage and an optimised counterweight, resulting in a well-balanced, solid machine.

All machine interfaces – including joysticks, keypad and LCD monitor – are ergonomically positioned and designed for optimum control and efficiency. Operators can work with comfort and confidence in the most challenging environments in the comfortable, spacious and low-noise cab of the EC950E.

Volvo's durable, high quality buckets are perfectly matched to the EC950E for digging in all working conditions. The General Purpose, Heavy-Duty or Extreme-Duty buckets are built with wear-resistant steel plates, making them well suited to quarrying and mining applications.

Both machines can be purchased from Babcock with Customer Support Agreements offering preventive maintenance, total repairs and a number of uptime services, while the latest in Volvo technology is used to monitor machine operation and status, ultimately resulting in increased profitability to customers and retention of asset value.

Photos: Arthur Tassell

"The A60H and EC950E are eminently suitable for local mining operations as their robust drivelines are designed specifically for challenging applications such as those found in the Southern African mining environment."

B&E provides short or long term

With over 40 years of experience in mobile and static crushing plants, Raubex company B&E International is known for its range of reliable interventions – from a stop-gap mobile plant in an emergency to a long term crushing solution on the mine site.

According to B&E International Managing Director Dewald Janse van Rensburg, it is often the company's capacity to respond quickly to a dire need that leads to a partnership that endures for decades.

"We can go to a mine at very short notice to assist them when, for instance, they experience a jaw crusher or secondary crusher failure that brings production to a standstill," says Janse van Rensburg. "We can move onto site quickly with a very large mobile crusher and keep production going for the weeks or months that it takes for a mine to get their own equipment back into operation."

B&E International's ability to do this is based not only on its engineering capability – it designs, manufactures, commissions and maintains crushing and washing plants for external mining projects – but on its experience of actually running these operations on behalf of clients.

"What distinguishes us from other design and engineering houses is that crushing and screening is our business," he says. "This is what we do every day on the infrastructure side of our operations, where we undertake contracts using our own mobile or static plants, crushing for large construction projects."

So successful were the company's initial operations from 1972 in blasting and excavating that it expanded into crushing and screening a few years later, and entered the mining services sector in 1993.

"We diversified into bulk mining, processing and beneficiation of minerals, although we do leave the final recovery stages to the experts in the mining companies themselves," he says. "Our customers include South Africa's largest mining companies, and we mine about 22 million tonnes a year currently, while also crushing, screening and processing about 12 million tonnes a year of ore and aggregates."

Janse van Rensburg emphasises how the first, short term contracts with many customers have led to ongoing partnerships.

"We always start with assessing exactly what is required, before making our proposals, so that we can design a plant that will meet expectations," he says. "While ensuring the appropriate specifications for the output needed, we are also very familiar with what the practical maintenance requirements are going to be and we design to make access easier and maintenance quicker. This is just part of the value to the customer that comes from running our own plants."

B&E International's rare combination of engineering capability and operational experience even allows it to assume some of the start-up risk faced by new mines, by designing a plant and running it on a 'toll' basis for a customer.

"For a new mining operation that is just starting up and which may not be able to fully fund all its facilities, we can design and actually run the plant on a 'tonnage rate' for an agreed period of time," says Janse van Rensburg. "The plant's efficient operation for, say, six to twelve months will prove to the mine that the plant can deliver in terms of the parameters required and the mine can decide on whether and when to take ownership based on how its cash flow improves."

The customer essentially pays for the amount of material processed, without having to pay

feature

crushing and screening solutions

for the equipment upfront. The capital value of the plant is built into the rate-per-tonne that is charged and B&E International runs the plant for an agreed period while the capital portion is steadily paid off.

"The advantage for the customer lies not only in having us carry some of the start-up cost, but in also having the assurance that the plant will function effectively as a vital part of the production process," he says. "Ownership can then revert to the mine after the capital is repaid through this toll fee. The customer can even decide to buy out the residual value of the plant at an earlier stage if their cash flow is good and they are confident of their own in-house expertise."

Word-of-mouth is traditionally where B&E International's business comes from, as its customers move between different commodities and mining companies; most of its work is currently in diamonds, copper, coal and gold.

"It's all about partnership really," Janse van Rensburg says. "For instance, we started a contract with one of our diamond customers in 1993, and we are still in partnership with them. On the coal side, we were called in by one of our early customers for a six-month contract, and we are still there many years later."

The usual scale on which B&E International conducts mining is up to about 500 000 tonnes per month, and it also engages in the development phase of projects by doing the stripping and mine preparation.

"On a copper mine, we can build the heap leach pad and manage that, and then the mine takes over when the material enters the metallurgical stages and the final recovery of copper," he says.

With its mining work mostly in South Africa, Botswana and Namibia, B&E International is also exploring opportunities in countries such as the DRC and Sierra Leone. The company's familiarity with moving crushing plants around the continent comes mainly from its previous crushing contracts in various African countries including Uganda, Tanzania and Mali. ■

Top: *A jaw crusher designed, manufactured and installed on a coal mine by B&E International.*

Above: *Erection of a plant designed and manufactured by B&E International.*

Above left: *A B&E International crushing plant on a copper operation.*

feature

Fourth MMD sizing station

What is undoubtedly one of the biggest applications of mineral sizer technology seen in South Africa reached a milestone earlier this year when MMD Mineral Sizing (Africa) commissioned a fourth MMD semi-mobile sizing station at Exxaro's Grootegeluk open-pit coal mine near Lephalale in Limpopo Province.

The new semi-mobile station comprises a primary 1300 Series sizer fed by a D9 apron plate feeder. A sacrificial conveyor transfers material to a secondary 625 Series sizer. The station is capable of processing coal at a rate of 3 000 t/h. Construction began in March 2016 and by the end of November the unit was relocated to its working position. Like the semi-mobiles before it, it was relocated in five sections down into the pit over a distance of 6 km using MMD's Atlas 500T transporter.

"The MMD sizing stations at the mine provide a complete in-pit crushing solution. The four semi-mobile stations have been delivered and installed over a period of six years. Although all four installations are similar, we have continually improved and customised the designs in the light of operational experience with the units and to meet the customer's evolving requirements," says Zane Nel, MMD Mineral Sizing (Africa)'s Engineering Manager.

MMD Mineral Sizing (Africa), which has had a presence in South Africa since the early 1980s with its manufacturing facility being expanded by 3 500 m² in 2002, is part of the MMD Group of Companies. The South African company is based in a modern office/workshop complex in the Longmeadow Business Estate in Johannesburg.

The MMD Group can trace its origins back to the late 1970s, when its founder, Alan Potts, set up shop to design and produce mining

This complete MMD turnkey semi-mobile installation at a graphite mine in the north of Mozambique is about to be commissioned.

feature

commissioned at coal mine

Above: *A 625 Series primary sizer (cap machine) in MMD's workshops in Longmeadow ready for dispatch to a gold mine in Burkina Faso.*

Above left: *The fourth semi-mobile station at Exxaro's Grootegeluk open-pit coal mine.*

solutions for the underground UK coal industry, initially designing and manufacturing in-line breakers. In 1980 he invented the twin-shaft mineral sizer which provided a technical breakthrough in mineral reduction.

The original mineral sizer developed by MMD was specifically designed to work in the confined space of underground coal mines and was able to handle tonnages of up to approximately 1 500 t/h. Building on the success of this original 500 Series machine, MMD now has a wide range of sizers with the biggest machine being the 1500 Series which was first supplied to operate within the oil sands industry in Canada.

Depending on the sizer shaft centres, machines can be configured for primary, secondary or tertiary crushing and all can be customised to the client's requirements. The full range of MMD sizers can also be supplied in fixed, mobile or semi-mobile configurations, with units being wheeled, tracked or mounted on skids.

Detailing the advantages of MMD's mineral sizers, Nel says that they are very compact and lightweight compared to more traditional crushers of the same capacity. He also points out that they have the ability to process not just hard, dry rock but also soft, abrasive and sticky materials which can often cause problems for conventional crushers. Moreover, the output from the machines is an accurately sized product with minimal fines.

Complementing its mineral sizers, MMD has a range of heavy-duty apron plate feeders to convey raw material to the crushing plant. The main features of the apron feeders are the heavy-duty chains and rollers which are attached to the main frame and which are manufactured by Caterpillar. The design of the feeders is such that impact energy is reduced to a minimum. Four feeders are available, designated the D4, D7, D9 and D11 and offering effective widths from 1 500 mm to 4 000 mm.

Nel says that MMD Mineral Sizing (Africa) is increasingly positioning itself as a turnkey solutions provider rather than just a supplier. "We have strengthened and expanded our local in-house design and engineering capabilities considerably in order to provide faster turnaround times and at the same time provide engineering solutions which comply with customers' specific specifications and unique requirements," he says. "We're also becoming involved during earlier stages of our customers' projects and every so often we're contributing to the pre-feasibility and feasibility stages. In addition, we're teaming up where appropriate with other suppliers during such phases."

In another development, MMD has installed a custom designed and manufactured dust hood on one of its semi-mobile plants at the request of the client in order to control the dust generated from the dump trucks that tip raw material into the semi-mobile sizing station. "The dust hood is very effective and the client is considering whether to fit hoods to its other stations," says Nel.

Despite the recession in mining, MMD

feature

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Mineral Sizing (Africa) has managed to remain busy over the past couple of years and has not had to downsize, a fate which has befallen many other companies dependent on the mining sector. "There are very few big projects around at the moment which require the utilisation of our bigger mineral sizers, either in South Africa or elsewhere on the continent," notes Nel. "Where we have excelled is with the smaller to medium-sized projects where we've typically supplied our smaller machines such as the 500 Series or the 625 Series."

Among the orders that Nel mentions are two 625 Series sizers for a gold mine in Burkina Faso, a 625 Series sizer for a mineral sands operation in Sierra Leone, an 850 Series sizer for a copper mine in the DRC, two 500 Series sizers for a coal mine in the Kriel area in South Africa and several machines for Sasol Mining, also in South Africa.

In Mozambique, a complete turnkey semi-mobile installation at a graphite mine in the north of the country is about to be commissioned. This comprises a D4 apron plate feeder and a 500 Series machine acting in a primary crushing role. MMD is hoping to receive further orders in the graphite field.

A Series 625 secondary sizer (segment machine) ready for delivery to West Africa.

Concludes Nel: "We are moderately optimistic on the prospects for the next year. There are a couple of potential upcoming projects along with a consistent demand for our sizer and feeder technology so we are confident that MMD Mineral Sizing (Africa) will continue to show healthy growth." ■

MMD mineral sizers offer three-stage breaking action

The basic concept of the MMD sizer is the use of two rotors with large teeth, on small diameter shafts, driven at a low speed by a direct high torque drive system. This design produces three major effects which all interact when breaking materials using sizer technology. The unique effects are: a three-stage breaking action, a rotating screen effect, and a deep scroll tooth pattern.

Initially, the material is gripped by the leading faces of opposed rotor teeth. These subject the rock to multiple point loading, inducing stress into the material to exploit any natural weaknesses. At the second stage, material is broken in tension by being subjected to a three-point loading, applied between the front tooth faces on one rotor, and rear tooth faces on the other rotor. Any lumps of material that still remain oversize are broken as the rotors chop through the fixed teeth of the breaker bar, thereby achieving a three-dimensional controlled product. ■

feature

Metso pushes the boundaries

New developments from Metso in the crushing field include the Metso MX™ cone crusher, described as an "industry changer", and the addition of high pressure grinding rolls (HPGR) technology to the group's portfolio, a development which has taken place over several years and which has seen the world's largest HPGR being installed at a copper mine in the US.

Kiangi Kiangi (left), General Manager MCA Sales Support, with Charles Ntsele, General Manager MCA Sales, both of Metso South Africa.

The Metso MX™ cone crusher was introduced at the CONEXPO-CON/AGG show in Las Vegas in March this year. It is based on Metso's patented Multi-Action crushing technology, which combines the piston and rotating bowl into a single crusher. According to Metso, it "provides a giant leap in profitability by cutting operational costs 10 % and enabling 10 % higher uptime compared to traditional cone crushers."

The key benefit of the Multi-Action technology is that it allows easy under-load setting adjustment and wear compensation without having to stop the process. Optimal cavity design, stroke direction and effectively distributed crushing action lead to the ultimate rock-on-rock crushing motion. This combined with the innovative Multi-Action technology results in extended maintenance intervals and higher production.

The Metso MX™ also provides maximised tramp release distance with high protection against uncrushable objects and overloading.

The Metso MX™ cone crusher features Metso's Multi-Action crushing technology.

feature

The crusher can utilise up to 70 % of the mass of new wear parts – a record-breaking utilisation rate. Thanks to the intelligent design of the crusher, the quality characteristics of all sized end-product fractions stay consistent throughout the lifetime of the wear parts.

Metso South Africa's Kiangi Kiangi, General Manager MCA Sales Support, says that while the MX™ has not yet been ordered by any local customers, it is expected to do well in the Southern African market. "This is a unique product which no other manufacturer can match," he says. "In developing it, Metso's engineers have rethought the basics of crushing to create a machine which builds on Metso's long experience with different cone crusher technologies to create a radically new product which pushes the envelope of cone crusher performance."

He adds that while the MX™ – which can handle throughputs of up to 600 t/h – would typically be used in a secondary position in the crushing circuit, the top sizes it can accept are much bigger than can be achieved with most secondaries. He also points out that most cone crushers in a secondary position struggle with fines. "This is not a problem for the MX™ Series and this alone will be a major selling point," he states.

Turning to Metso's HPGR technology, Kiangi's colleague, Charles Ntsele, General Manager MCA Sales, notes that comminution machines of this type have been around for many years. "Despite the fact that Metso is the world's biggest manufacturer of crushers, we did not have a foothold in the HPGR market until fairly recently. When we decided to enter the market, we had the option of either buying in the HPGR technology we needed or developing it in-house. We chose to develop in-house and the result is that we now have a complete – and innovative – line of machines which we market under the HRC™ HPGR banner and which we believe are the most advanced high pressure grinding rolls on the market."

HPGRs utilise two counter-rotating tyres or rolls – one fixed and one floating – in order to effectively crush ore. Hydraulic cylinders apply very high pressure to the system, causing inter-particle comminution as the feed travels between the two rolls. Key benefits include very energy-efficient operation and the fact that no grinding media are required.

Says Ntsele: "Metso has made a number of innovations that have focused on increasing throughput and decreasing the total cost of operations. Our machines use fewer kilowatts per ton of throughput and also produce a much finer product than competitor machines."

The HRC™ 3000, seen here, represents the fruits of a close collaboration between Metso and Freeport-McMoRan.

While Metso may be a latecomer to HPGR technology, it is already a leader in the field and an installation commissioned at Freeport-McMoRan's Morenci copper mine in Arizona in the US in 2014 ranks as the largest fully operating HPGR in the world. Ntsele mentions that the machine – the HRC™ 3000 – represents the fruits of a close collaboration between Metso and Freeport over several years which saw extensive pilot plant testing and which also addressed some of the inherent limitations of conventional HPGRs.

The HRC™ 3000 at Morenci has 3,0 m by 2,0 m wide rolls, a total installed power of 11 400 kW and a total installed weight of 900 tons. It is the first HPGR to incorporate features such as a flanged roll design and a patented anti-skewing arch-frame. Depending on the application, the total capacity of the machine can exceed 5 400 tons per hour of ore.

Ntsele says the collaboration between Metso and Freeport McMoRan illustrates how Metso can work with customers to improve existing equipment and processes. "We are a solutions

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provider, not just an equipment supplier and can provide real benefits to our customers by combining our considerable resources in South Africa with the expertise of Metso engineers around the world," he observes.

The Metso group is headquartered in Finland but operates globally and has a workforce of around 11 000 people in more than 50 countries. It operates over a range of industries but mining is a prime market, accounting for just over half of all sales. Its products for mining include mills, crushers, screens, bulk materials handling systems and process equipment. Metso is listed on the NASDAQ OMX Helsinki and in 2016 had total sales of approximately Euro 2,6 billion. ■

Another view of the HRC™ 3000, which has a total installed power of 11 400 kW and a total installed weight of 900 tons.

Two big African orders for primary crushers secured

Big mining projects are currently thin on the ground in Africa – which is why Metso South Africa can take satisfaction from securing two major – and keenly contested – contracts in the mining field recently.

One of the projects is Vedanta's Gamsberg zinc project in the Northern Cape where Metso has won the supply of the primary jaw crusher, a C200™ model, a pebble crusher, an HP3 model, and three stirred media detritors with two being the SMD-355™ model and one the SMD-90™ model.

The second major contract won is for the supply of a primary gyratory crusher (PG54/75 Superior model) and a C150 primary jaw crusher to Newmont's Ahafo site in Ghana, where both a plant expansion and an underground expansion known as the Subika Underground mine have been approved. ■

feature

Screen media brand builds on FLSmidth's global footprint

With a South African heritage going back over 110 years, the FLSmidth Meshcape® Screen Media product brand offers the mining sector not only a full range of wire screens and screen media but the footprint of global FLSmidth.

According to Ross Dott, FLSmidth's Business Development Manager for Meshcape® Screen Media products, the market has become increasingly globalised and competitive, making long term relationships with customers even more vital.

"With our global footprint, we are able to offer the market a total package and this is a major differentiator," says Dott. "In addition to our wide range of screen panel solutions, we provide that unique mix of capabilities with skilled technical staff all over the world in our Supercenters and Technology Centers."

FLSmidth Meshcape® Screen Media, with its extensive engineering expertise and high quality manufacturing capacity in South Africa and Australia, is the largest supplier of woven wire product in the southern hemisphere.

"Unlike many of our smaller competitors, we cater for the entire range of screening products so we can provide solutions to any market that has a processing operation that needs to screen, sieve, sort, size, filter, protect, support, freeze, dry, dewater and reinforce," he says.

"Our primary objective is to help our customers achieve the lowest cost per ton in their production process."

FLSmidth, through its global network, is able to leverage technical skills as well as a logistical supply chain that ensures optimum responsiveness to customers, and this is particularly relevant to its screen media customer base.

"Our primary objective is to help our customers achieve the lowest cost per ton in their production process," says Dott. "You can only do that if you specify the right wire for the application; this requires experience in both the manufacturing and the application of screen media, which we have in abundance."

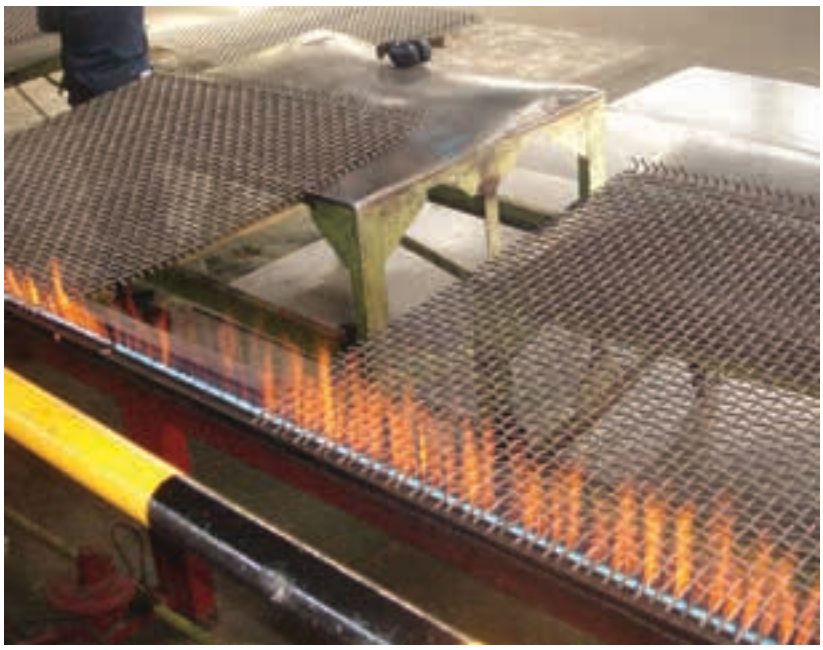
He emphasises the importance of understanding the customer's operation, as the business is no longer about just selling wire screens – rather, it is about adding value to the customer's business. Understanding the density of the material being processed, for instance, is a key aspect of specifying correctly; this allows wire thicknesses to be reduced as far as possible.

"It is a fallacy that thicker wire is better," he says. "In the production process, the wire's tensile strength rises the more it is drawn. It is also more difficult to properly tension thicker screens, and if they are not tensioned correctly they may be prone to breakage and could fail prematurely."

Wire strands that are optimally specified will also give the screen greater open area and will reduce costs as thinner wires are used. This will also lighten the mass of the screen, making the machine lighter and more efficient.

He highlights the fact that a vibrating screen is perhaps one of the best fatigue testers available.

"For a strand of wire to withstand the forces of a screen moving up to 10 000 times a minute, it requires highly specialised engineering and



feature

tensioning to enhance its longevity," says Dott.

He says FLSmidth can provide on-site technical assistance during screen media product installation, maintenance or repairs at the customer's mine or quarry site. The specialised services that are offered include process optimisation, specialty product development, screen surfaces audit, and screen system and component installation.

"We also analyse product performance, and identify abnormal wear patterns and recommend corrective action to ensure that customers get the most value from the products and drive down their unit costs," he says.

The 16 500 m² FLSmidth Meshcape® Screen Product manufacturing facility in Edenvale supplies local South African markets and exports to Africa as well as the Indian Ocean islands. The facility is quality accredited by Bureau Veritas Certification with ISO 9001 for all manufactured products.

The FLSmidth Meshcape® Screen Product range includes heavy woven wire screens – featuring 0,71 to 20 diameter wire – which are generally made to order due to the various operating requirements found in the mining and aggregate industries. The brand is also well-known for its popular GMS and AISI 304 screens, which are carried in stock.

Popular sizes of fine woven wire mesh, which range in size from 6 to 500 mesh, are also carried in stock, while the extensive production capacity allows for special requirements to be woven to customer specifications.

As the only South African manufacturer of wire conveyor belts, FLSmidth makes these Meshcape® Screen Media products to order for numerous applications in different markets. "We've even used our steel conveyor belts with a thicker gauge wire to support hanging walls in an underground diamond mine," says Dott.

The FLSmidth Meshcape® Screen Media polyurethane screens include the latest generation BPS modular pin-type screening system, which is fully interchangeable with current versions. "The BPS has been designed to maximise the open area, offer high panel integrity and withstand operating at forces of up to 10 Gs," Dott says.

The company is also a leading manufacturer of wedge wire, with aperture sizes ranging from 500 micron to 10 mm with a range of different materials to suit the different markets, profiles and support bars. Applications for these items include fully-welded centrifuge baskets, screen baskets, flat panels, sieve bends, water intake screens, water well screens, inter-tank screens and trommel screens.

"FLSmidth Meshcape® Screen Media is committed to supporting its existing customer base in Africa as well as pursuing a long-term growth strategy throughout the region. We are also working with our agents in Zambia and Namibia," Dott says. "As part of FLSmidth, we can also conduct product variation with our Australian products, which have valuable applications in our areas of jurisdiction."

Apart from its involvement in mining and aggregates, which includes segments like base metals, coal, chrome, diamonds and gold, the company also has an industrial sector that serves sectors such as chemicals, food and beverages, engineering, paper and pulp, and agriculture. ■

Below left: *Quality manufacture forms the backbone of the FLSmidth Meshcape® Screen Media product brand.*

Below centre: *A hybrid poly wire modular panel.*

Below: *Vibro Optimax™ wire has a higher tensile strength than standard screen wires with better wear characteristics.*

feature

Yanfolila gears up for production

The ball mill for Hummingbird Resources' Yanfolila gold project in Mali was recently unloaded at a port in West Africa. The mill was constructed predominantly in Italy, France and Holland with the work been overseen by Outotec. The mill represents a significant part of the process plant and was completed on budget. It is due to arrive on site on schedule this month (May).

The Yanfolila ball mill was recently unloaded at a West African port (photo: Hummingbird).

Hummingbird, whose shares are quoted on AIM, reports that construction of the 1,2 Mt/a Yanfolila mine is progressing on time and on budget ahead of initial mining targeted in Q3 2017 and the first gold pour by year end.

Construction of the CIL tanks commenced in Q1 2017 following the successful construction of the tower crane. Construction is on-going and is expected to be completed shortly. All drawing and design work has been completed for the crushing circuit and the fabrication is now underway. The secondary crusher and vibrating grizzly are already on site and various parts will be delivered through to August this year.

Yanfolila will have an average annual gold production over a Life of Mine (LOM) of eight years of 107 000 ounces although the first full year of operation will see 132 000 ounces being produced. In all, some 8,7 Mt of ore (at an average grade of 2,95 g/t and a LOM strip ratio of 11,9 to 1) will be mined over the mine life to produce a total of 770 000 ounces.

The EPCM contractor for the plant and associated infrastructure is South African project house SENET while IMAGRI-SARL – a Malian contractor – is responsible for the civil works and SMPP work. African Mining Services (AMS), a subsidiary of ASX-listed Ausdrill, has been selected as the mining contractor. ■

Weba solves plant stoppage problem

A solid reputation as the preferred supplier for transfer points on diamond operations has seen South African OEM Weba Chute Systems service the mines in Botswana for the last 15 years.

Werner Baller, founder and CEO of Weba Chute Systems, says that the company does not rest on its laurels and he attributes its success to its philosophy of continuous improvement as well as its in-depth understanding of material movement across the full range of commodities.

"The ability to fully understand the complexities of crushing systems enabled our technical team to provide a fit-for-purpose solution in a retrofit application on one of the mines recently," Baller states.

Explaining the application itself, Baller says that the transfer point operates between a crusher and material stockpiles and that over the years various challenges had been encountered including high impact on the belt and excessive dust and spillage with associated high maintenance costs.

In this section of the plant, some 3 500 t/h of kimberlite is transferred from the open pit to the stockpile. Although several modifications were done over time, the plant stoppages caused by the ineffective transfer point had become a major problem.

"Due to our standing in this particular industry and our close relationships, Weba Chute Systems was called in to investigate and provide a long-term solution," says Baller. The company's team of skilled engineers visited the site with mine personnel to get a complete picture of the situation.

The solution provided was a custom transfer point engineered to meet specific application requirements.

Baller points out that the emphasis during the design stage was on mitigating the major issues of the past, one of which was the very high drop of 15 m which the material has to transverse before reaching the belt.

Weba Chute Systems' pragmatic approach to the dynamics of bulk materials handling not only eliminates the problems so often associated with conventional transfer chutes but also results in significant savings, Baller notes. He adds that it is extremely important to understand how the material flow will function in all conditions including wet and dry.

"Uncontrolled drops such as this result in high impact on the belt. It is through the absolute control of the material flow that we are able to reduce the impact of the product when it reaches the conveyor. This not only reduces wear on the belt but also reduces spillage and dust," he says.

"Because each Weba Chute System is tailor made for its specific application, we are confident that the plant stoppages at this mine will become a thing of the past," Baller concludes. ■

An illustration of the Weba Chute System custom engineered transfer point at a diamond mine.

feature

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Composite deck systems take screening to a new level

While the concept of composite decks, which comprise panels of various materials, apertures and configurations, is not new, screening media specialist Multotec has, for over a decade, developed the added value that this approach can bring to a customer's bottom line.

Seen here in discussion are Shawn Faba (left) , Product Manager Screening at Multotec Manufacturing, and Roy Roche, Vice President Screening Media at Multotec.

Multotec Manufacturing's Product Manager Screening, Shawn Faba, believes that Multotec's composite deck systems have taken screening technology to another level. "By applying the science of stratification, we ensure we can design a screen that produces the size and specification of output required by the customer; we then also engage in 'the art of screening' by meticulously fine tuning the process through monitoring and iteration that leverages our market-leading Hawkeye technology," he says.

"We differentiate ourselves by the in-depth way we use our Deck Map methodology to design and optimise solutions, based on the characteristics of the material being treated. This also allows us to adapt our solution to the dynamic nature of orebodies, which leads to constant changes in the material to be treated, even in the same orebodies."

The 'deck map' is the guide to the planning, design and fine tuning of the composite deck, allowing the best combination of panels to be placed to suit the conditions, the material and the output targets. With decades of experience in screen panel manufacture, Multotec produces a wide variety of purpose specific panel types, from materials including rubber, polyurethane, steel, woven-wire, ceramics, Hardox, fibreglass and combinations of these materials.

"The deck map allows us to specify, for instance, a set of panels comprising highly impact resistant material at the feed end of the screen, where the impact of material from the feed box or chute is highest," says Roy Roche, Vice President Screening Media at Multotec.

Choices might include Multotec's RubCer wear product manufactured with both rubber and ceramic elements; the extremely hard ceramic surface provides exceptional resistance to wear and cutting, while the rubber's elastic properties dampen the impact forces and protect the ceramic pieces.

Alternatively, the commodity and application may be best suited by the RubMet product, in which Hardox 500 sections are embedded in rubber. Plates designed with small Hardox blocks are more suitable for medium to large particles, while those with strips of Hardox work best for large ore particle applications.

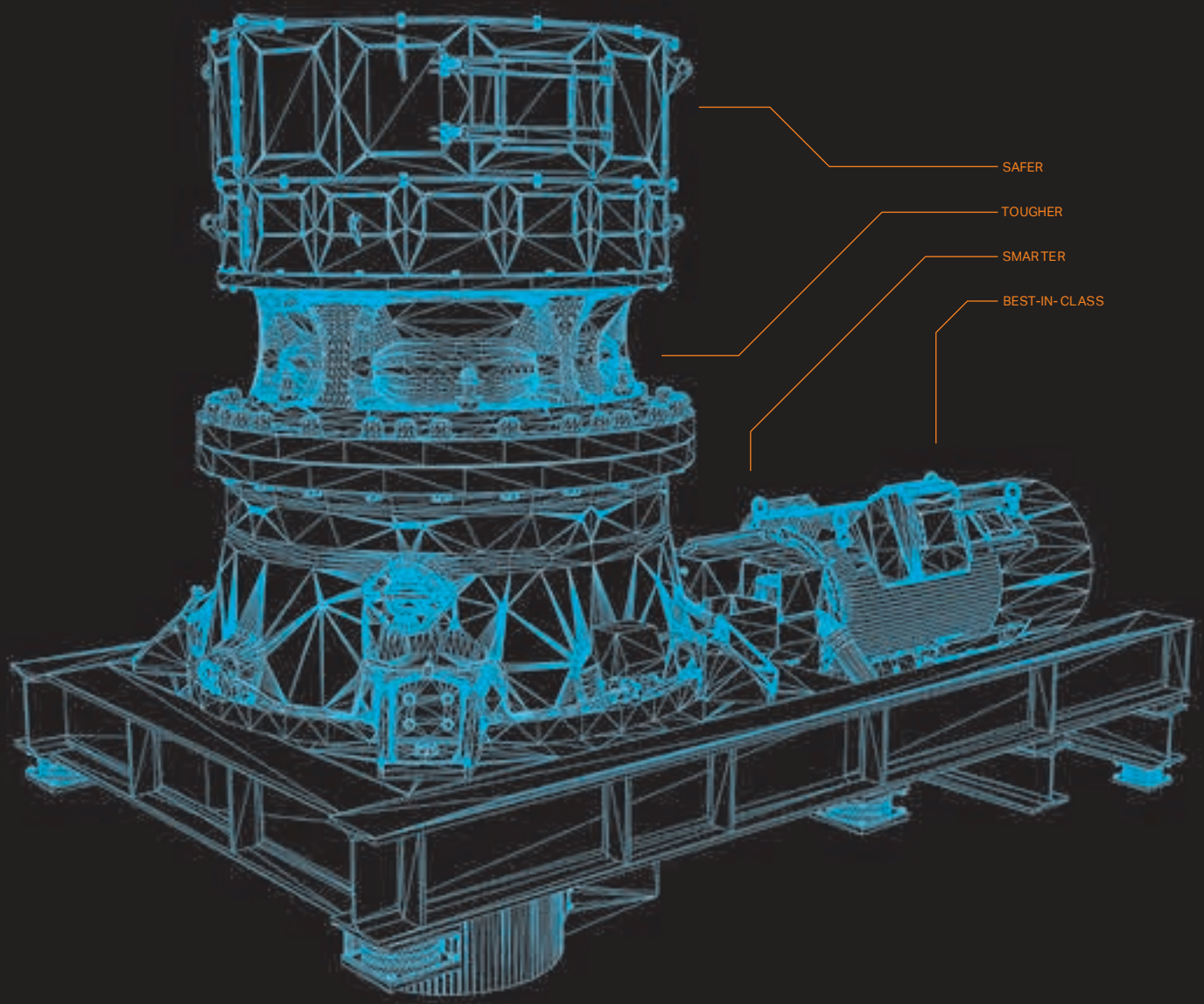
"One deck might comprise over a dozen different types of panels, and each one is there for a very specific reason," says Roche. "The apertures will be chosen according to the screen's purpose and factors like the feed tonnage required, the average particle size and the particle shape; we cater for the full range of screening applications such as scalping, desliming, dewatering and sizing."

To cater for all these demands, in just about every commodity mined globally, Multotec's panel offerings include solid feed-end panels, slope change panels, slotted aperture panels for high velocity zones, and square aperture panels for low velocity zones depending on bed depth and cut size.

A key requirement in screening is also to

Shawn Faba examines a Losiplast panel, which is suitable for heavy duty applications.

feature



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spread the material as evenly as possible across the deck, so that the cut points are even across the surface and the wear rates are more or less uniform to allow for predictive failure patterns and to facilitate longer replacement intervals. Multotec's panel options also include purpose-built deflectors that can be strategically deployed in the deck map design to assist with this spreading function.

"Downtime is a primary concern for all our clients," says Faba. "So our composite deck designs must ensure that wear patterns are as even as possible, so that we can extend the mean time between failures (MTBF) and conduct scheduled maintenance as infrequently as we can. Typically we want to ensure that customers can run these screens for six to eight months at least before they have to schedule maintenance downtime."

This is where Multotec's Hawkeye is pushing the boundaries, by systematically managing and analysing the data from the deck maps, creating a powerful planning system for ongoing application improvement. By tracking the performance over time of the various panel types on each deck in operation, the screening requirements in each part of the deck can be constantly refined.

"The composite deck concept opens the door to almost infinite combinations in the placement of particular panel types, and the sheer bulk and complexity of the data from each screen on each operational site needs to be carefully managed and analysed to make it useful," says Roche.

He emphasises that Multotec's screen panels are also commonly used in double-deck formations, which substantially increases the amount of data being collected.

Leveraging performance data is likely to become an exciting field feeding into technological advancement, especially in the light of the process guarantees that bind every player in the supply chain to their commitments, says Faba.

An example of a composite deck layout.

"The scientific use of this data can help us respond positively to the mining operation's changing ore characteristics, through our comprehensive feedback loop," he says. "This extends from our technicians on site, back through our design facilities, to sales engineers, and into our manufacturing processes. We can assess how well the existing deck map design is meeting the client requirement, while picking up guides and pointers from the data about how best to adapt to changing ore conditions."

Underpinning the interchangeability of panels on composite screen panel decks is the modular format of Multotec's two common panel sizes – 1' x 1' or 2' x 1'.

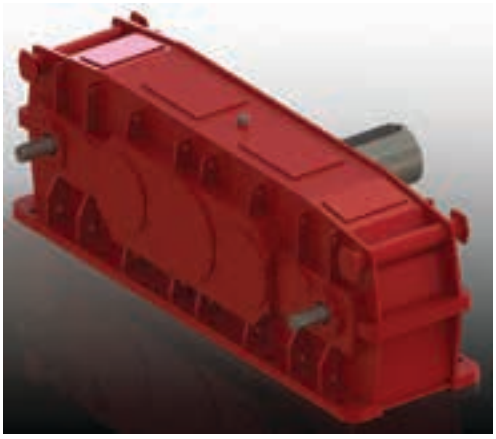
"This modular design allows for the different types of panels to be placed in specific areas of the screen as part of the overall goal of achieving metallurgical efficiency on the screening media surface," Roche concludes. "Our experience is that modular panels can cut operating costs on screen decks by up to 30 % plus, when using iterative improvement techniques." ■

feature

Hoist drive from SA ordered by Canadian mine

A 24-t ZDN hoist drive, representing one of the largest single units from SEW-EURODRIVE South Africa to date, is to be supplied to a mine in Canada for a hoisting application. Traditionally known as specialising in smaller geared motors for conveyor applications, SEW-EURODRIVE has the capability to manufacture custom components up to the size and complexity of girth gears.

The order for the fast-track project was received in December 2016, with the initial kick-off meeting held in January 2017, says Rudi Swanepoel, the company's Head of Projects. "To the best of my knowledge, this is the biggest unit that SEW-EURODRIVE South Africa has ever supplied. In my experience, I have never quoted on a unit of this magnitude before. It is a real feather in our cap, especially seeing we were awarded the project by a leading competitor, which gives us a good foot in the door in securing future orders."



The ZDN 3 HSN 1670 hoist drive.

The global presence of SEW-EURODRIVE is another major factor which contributed to the company securing this flagship project, with the ZDN 3 HSN 1670 hoist drive being designed and manufactured in the Czech Republic.

The hoist drive has two input shafts, driven by two 1 000 kW motors, driving helical bevel gears that, in turn, drive the single output shaft of the gearbox, and thereby the specific hoisting application. "The reason we had to do this was in order to comply with the specific requirements of the customer, who is looking to standardise on 1 000 kW units on-site," Swanepoel says. "This means a more streamlined and cost-effective stockholding for all applications."

The hoist drive features special oil coolers fitted for thermal and heat dissipation, including additional auxiliary equipment. Heat dissipation is a critical consideration, because the higher the kilowatt rating, the higher the required thermal rating of the gearbox will be, which calls for additional cooling.

The huge amount of torque generated on the output shaft is an astonishing ±1,5 million Nm, as opposed to 475 000 Nm for the largest X-Series industrial gear unit produced by SEW-EURODRIVE to date. Due to the high torque requirements, the OEM was also able to assist with special tangential keys on the output shaft.

"The application of the hoist drive is to convey both mineworkers and goods, which meant that strict health and safety requirements and safety factors had to be accommodated," notes Swanepoel. This also meant that a much higher service factor had to be taken into consideration.

SEW-EURODRIVE South Africa has subsequently clinched a major order for the second stage of the project, a ML Series unit for a goods-only application, which is currently being assembled at the OEM's manufacturing facility in China to international DIN standards. The power rating of this second hoist drive is 1 000 kW, with a nominal torque of 293 000 kNm.

"The second unit is going to the same mine but the application is a goods-only hoist lift in a deeper underground section for ore transportation. This is also a one-off order, with special attention paid to the service factor and maintainability in order to increase its cost-effectiveness," Swanepoel explains. The second unit, which has a mass of about 11 t, will have a 24-week delivery period.

SEW-Eurodrive, tel (+27 11) 248-7000

Precision balancing of rotating machines

As the operator of the largest independent high speed dynamic balancing machine in sub-Saharan Africa, Marthinusen & Coutts, a division of ACTOM, has an in-depth understanding of the importance of precision-balancing rotating machines.

Mike Chamberlain, marketing and commercial executive at this leading local repairer of rotating electrical and mechanical equipment, points out how critical it is to ensure the highest degree of accuracy when balancing rotating machines as this will minimise vibration levels, thereby increasing reliability and reducing maintenance costs.

The 32-ton Schenck HM7 U/S balancing machine, located at Marthinusen & Coutts' 9 500 m^2 high- tech workshop in Cleveland, near Johannesburg, is in constant use. "Our customers, which include major local and international OEMs, benefit significantly through access to an independent balancing service offering with this level of capacity and quality."

The HM7 U/S balancing machine has a measuring range between 100 and 5 000 rpm. It is 9 m long, has a journal size of 400 mm and a swing of 2,4 m. The machine is fitted with a CAB 920 H computer measuring system with advanced functionality.

"This state-of-the-art technology makes changeovers to new rotor types quick and straightforward, and the machine is capable of balancing larger high-speed rotors dynamically at full operating speed," Chamberlain says. He adds that, on occasion, and depending on the design of the rotor and the individual customer requirement, balancing can be done at 10 % overspeed or more if required.

Marthinusen & Coutts also performs on site vibration and dynamic balancing with its recently acquired Bently Nevada ADRE 408 portable vibration and balancing system.

Marthinusen & Coutts, tel (+27 11) 607-1700

Marthinusen & Coutts operates the largest independent high speed dynamic balancing machine in sub-Saharan Africa.

Accurate 3D spatial monitoring with new Sentry system

Maptek's recently upgraded Sentry monitoring system is a laser-based solution for the constant surface monitoring required by geotechnical teams and mine management for managing risk. Intuitive 3D visualisation of movement and powerful analysis tools are combined in one easy to use, turnkey solution.

The Sentry DMS (Deployable Monitoring System) was unveiled in March this year alongside the third generation Maptek I-Site laser scanners.

Deployed in a custom trailer, the system offers a power and communications module, cellular and wi-fi networking, a dedicated, stable bollard for an I-Site laser scanner and Sentry software. The trailer is driven to the desired monitoring location and parked. Users can unpack the system and start monitoring in 15 minutes.

"Geotechs welcome the idea of a system where they can just hit the button to start monitoring. Quick and easy setup is ensured by the new configuration and there is no need for the surveyor to organise the workshop to build a bollard for mounting the scanner," says Maptek. "Alert levels and rules are easily defined, allowing critical information to be sent direct to geotechnical staff or mine managers so they can decide on action to be taken."

Sentry allows users to analyse the mechanics of wall failures with greater fidelity than other systems. Generating 3D digital terrain models (DTMs) or overlaying 3D imagery on heat maps coloured by displacement or velocity provides an overview of movement. Zones can be animated over time to show morphology of terrain changes and this information then used to predict movement in other areas.

The captured laser scan data can be used for any number of other spatial monitoring tasks, such as per shift dig reconciliation, design conformance, geological mapping and kinematic analysis.

Sentry helps site personnel monitor and report on movements caused by surface instability that have the potential to interrupt operations. It can be applied to mining and civil engineering projects including road cuttings, land slips, dam walls and tunnel openings.

Sentry monitors multiple zones within a scene without the need for targets or reference points. Movement can be detected down to 1 mm per hour. While radar systems can monitor even smaller movements, they have limitations when there are large movements.

Maptek, tel (+27 11) 750-9660, website: www.maptek.com/sentry

The Sentry monitoring system is deployed in a custom trailer.

Pumprite a key part of BMG's fluid technology portfolio

BMG's Pumprite range, which forms part of the company's fluid technology portfolio, encompasses lubrication, grease, oil and abrasive fluid handling equipment, designed and manufactured locally to cope efficiently in Africa's arduous operating conditions.

"BMG's strategy to enhance its fluid technology services to meet growing market demand in diverse industries incorporates the introduction of new products, with the latest developments in design technologies, materials and coatings," says Weylin Kapp, National Product Manager, Lubrication, BMG.

Pumprite heavy duty retractable reels are used for high performance transfer of lubricants and abrasive fluids.

"The company's expansion programme in the fluid technology sector also involves increasing product stockholdings through more than 160 BMG branches and a wide distribution network in South Africa and across borders into Swaziland, Zambia, Botswana, Mozambique, Namibia and Tanzania."

Pumprite equipment – a key brand in BMG's portfolio – has been designed for use in diverse applications, including the transfer of product, lubrication of machinery, greasing, pack setting, rock grouting, washing, fixed and mobile systems and draglines.

Pumprite pneumatic and manual pumps handle a wide range of products that include grease, oil, chemicals, grout and cement, air, water, hydraulic oils, diesel fuel and detergents.

BMG's Pumprite grease range encompasses pneumatic grease transfer pumps, heavy duty retractable hose reels, spring feed lubricators, foot-operated grease pumps, bearing packers and hand lever grease guns.

Products recommended for handling viscosity oils include pneumatic oil pumps and retractable hose reels for oil and fuel. The manual oil and fuel range also includes pumps for gear oil, hand rotary pumps and wing pumps.

The pneumatic abrasive pump range handles cementitious products and wash/solvent pumps efficiently handle all water based fluids, as well as chemicals, acids, solvents and anti-freeze.

Robust Pumprite pumps, with a refined design that can be stalled without damage, also ensure failsafe operation in arduous conditions. The reciprocating air piston has been designed for an even and non-pulsating delivery of product.

Weylin Kapp, BMG, tel (+27 11) 620-1500

Namakwa Sands dust extraction system refurbished

Global mining, materials handling, minerals processing and equipment supplier TAKRAF Africa has recently refurbished a dust extraction system which the company installed at the Tronox Namakwa Sands Mineral Separation Plant (MSP) at Koekenaap in the Western Cape more than 20 years ago.

While the refurbished system has the same capacity as the original system, it now offers significantly increased dust collection efficiencies to meet new and more stringent environmental regulations.

Operating on the West Coast of South Africa, Tronox Namakwa Sands mines and beneficiates heavy minerals to produce titanium dioxide feedstock (chloride and sulphate grades), zircon, rutile and high purity iron products.

TAKRAF Africa's scope of work covered refurbishing the existing Tenova reverse pulse bag filter systems, making modifications to optimise the ducting system and equipping the filters with new filter bags. Handling ilmenite, rutile and zircon dust and reducing the dust load from 15 g/Am^3 to less than 20 mg/Am^3, the refurbished Tenova bag filters collect dust from various dust sources in the MSP building via the partially new ducting system. Dust disposal is by means of a new double flap valve below each trough hopper into a dust sealed mobile dust skip.

TAKRAF Africa was responsible for mechanical dismantling and erection to hot commissioning of the system.

The original dust extraction systems were installed in 1995 by the equipment supply division of the then Bateman group of companies before it was acquired by the international Tenova group in 2012.

TAKRAF Africa has installed approximately 2 000 reverse bag filters in a range of industries in South Africa. The bag filters can handle flow rates between 0,5 and 100 m^3/s, with high collection efficiencies of >99,99 %.

TAKRAF Africa, tel (+27 11) 201-2300

Trend towards vertical turbine pumps

A trend towards the use of vertical turbine pump (VTP) technology – which is gaining momentum in sectors including petrochemical, mining and bulk water – is based on a number of valuable benefits over traditional options.

According to Kevin Roelofse, Weir Minerals Africa's Dewatering Product Manager, Floway® vertical turbine pumps have particular advantages for applications such as booster pumps in bulk water applications and for condensate extraction in facilities that operate boilers, such as power stations. The release of a Floway® vertical turbine slurry pump (VTSP) also represents a technology breakthrough that is being well received.

"In booster pump stations, VTPs allow savings on civil engineering infrastructure as they have a smaller footprint, but more significantly they offer important operational cost efficiency related to reliability and lower maintenance," Roelofse says. "The VTP can be multi-staged, with numerous impellers in the column, for large volume and discharge pressure applications."

While the traditional horizontal pump can offer up to a two-stage horizontal split casing configuration in a large-volume application, the impeller needs to be of a substantial size.

"This means that the impeller tip speed will be high, so it will wear quicker and require more maintenance," he says.

By contrast, the VTP achieves lower wear and less maintenance by incorporating a number of smaller impellers along its column, so the speed at the impeller tip is lower.

The operators of any facility that includes boilers – common in the energy generation, paper and petrochemical sectors – will know the challenges facing condensate extraction pumps. This equipment, vital to the movement of condensed steam, faces the danger of cavitation or pitting of impellers leading to inconvenient and costly downtime for replacement.

"If there is insufficient suction pressure on the hot condensate then the vacuum existing at the suction of the impeller can exceed the water vapour pressure and can cause it to vaporise, imploding onto the impeller vanes and causing considerable erosive wear on these impeller vanes due to cavitation," Roelofse says. "This is devastating for the longevity of a centrifugal pump."

The VTP comes into its own in these condensate extraction applications because the vertical column length can be designed in such a way that there is sufficient downward pressure of the condensate, restricting its ability to vaporise and damage the impeller vanes.

Floway® pumps are designed and manufactured under one roof at Weir's state-of-the-art facility in Fresno, California. All the products embody a high level of in-house engineering capabilities including three-dimensional solid modelling; hydraulic design; computational fluid dynamics (CFD) analysis; stress and deflection analysis using finite element analysis (FEA) and lateral and torsional rotor dynamic analysis.

Weir Minerals Africa also offers the African market a recent Floway® innovation – the vertical turbine slurry pump (VTSP) – launched two years ago to serve the industry's need to pump dirty water with specific gravity ratings of up to 1,2.

"It is not common for vertical turbine pumps to be employed in applications of this range of specific gravity, so this product is a real pioneer," Roelofse says. "The VTSP is particularly successful because it addresses and is designed to eliminate the two key contributors to the failure of centrifugal pumps: the mechanical seals and the line shaft and bowl bearings."

Rene Calitz, Weir Minerals Africa, tel (+27 11) 929-2622

The Floway® VTP during installation at a customer's site.

Specialised dewatering solutions from Franklin

Franklin Electric is utilising its commitment to – and understanding of – complex dewatering applications together with cutting-edge scientific methodologies to offer specialised dewatering solutions in South Africa that it claims are 40 to 80 % more cost effective than others on the local market.

Application Engineering Manager for Franklin Electric SA, Lyon van der Merwe, says the company's specialised dewatering solutions represent a problem-solving approach that offers durability and ease of repair resulting in increased uptime and an overall reduction in cost of ownership.

The pumps that are used for mine dewatering must be able to operate in extremely hostile conditions and are often situated deep underground, which can adversely affect their operation and make servicing difficult and time consuming, negatively affecting the viability of the mine.

Franklin Electric has incorporated specially developed and patented technology into its pumps, motors and control systems to ensure that repairs are quick and cost effective while a state-of-the-art monitoring and control centre uses a Variable Frequency Drive (VFD) system to integrate water flows, levels and measurements.

All parameters are recorded, logged and made available for operational and management purposes. Data and operational information can be accessed remotely via satellite (BGAN), cellular (GSM), Wi-Fi or radio systems.

The VFD system is pre-programmed to manage and protect the motor and pump, accept transducer signals to ensure that the operation is controlled as well as collect all information and link it to the Remote Terminal Unit (RTU).

The SCADA control system developed by Franklin Electric for dewatering monitoring and control applications makes use of an RTU strategically placed in the mine dewatering field that is configured to collect direct and indirect VFD data such as voltage, current, frequency, torque, consumed power, operating time, pressure and flow rates.

Gideon Swanepoel, Franklin Electric, tel (+27 11) 723-6500

REFLUX™ Classifier technology gains popularity in coal

REFLUX™ Classifier (RC™) technology is reported to be rapidly gaining popularity in coal processing applications in Africa because of its ability to easily handle varying feed conditions which are a reality in mining operations.

According to FLSmidth, traditional technology cannot accommodate these feed variations resulting in recovery losses whereas the RC™ is a lot more forgiving of solids feed rate variations. This allows a consistent separation and, as a result, a higher separation efficiency.

This photo illustrates the underflow arrangement of a REFLUX™ Classifier.

FLSmidth has an installed base of RC™ technology in coal applications in the Waterberg and in Mozambique.

Terence Osborn, Commercial Manager of Minerals sub Saharan Africa at FLSmidth, says that as the coal processing industry has grown in Mozambique, so too has the adoption of FLSmidth's RC™ technology by multiple mines in this country.

The first four RC™ 3000 units sold in this region are the largest in the FLSmidth range and were among the first such units to be sold globally.

Each of these units, now installed and commissioned, is capable of treating approximately 200 t/h of raw fine coal.

Significantly, the success achieved by the RC™ technology in the second phase of this coal processing plant resulted in it being chosen as the technology of choice for retrofit to the original plant. Prior to this, test work was conducted on site by FLSmidth using its mobile test RC™ 300 rig to validate the expected performance of the larger RC™ units.

The results from the pilot plant test work proved a business case to replace the existing spiral technology, leading to the sale of four additional RC™ 3000 units to the mine. These will be commissioned when the extension to the existing plant is completed.

Osborn says the success achieved with the technology can be attributed to the fact that it offers far greater process flexibility in operation and generally has a higher efficiency which produces higher recovery at similar ash content.

The RC™ incorporates a 'laminar high shear rate' mechanism, which represents the latest in fine particle gravity-based separation technology. The lamella section enhances the efficiency/capacity of the RC™, producing a more compact and efficient separation unit when compared to competing fine coal and mineral processing equipment.

FLSmidth offers commercial units from the RC™ 850 (850 mm diameter, 18 to 20 t/h) up to the RC™ 3000 (3 m diameter, 200 to 250 t/h), with actual unit capacities related to the feed material and the feed material sizing.

Terence Osborn, FLSmidth, tel (+27 10) 210-4820

New Potain tower crane for Malian gold mine

A Potain tower crane is being supplied by SA French to a mine in Mali.

A gold mine in Mali was so pleased with the performance of – and support for – its on-site Potain tower crane that it has replaced it with another Potain unit.

With the de-rating of the mine's Potain MD830 crane due to its age, local distributor SA French is supplying the new Potain MCT205 tower crane for general maintenance and repair duty on the remote mine site.

SA French Sales Manager Louw Smit says that technical and after-market support are considered critical for customers, and even more so for those who operate on remote sites in Africa.

"Significantly, SA French has been recognised as an Elite Dealer by Potain of France, which means a guarantee of 80 % availability of spare parts on first call, and it is this level of customer centric focus that has ensured the success of Potain cranes in Africa," he says.

"We dismantled the crane for our customer in November last year, and the brand new Potain MCT205 model is being supplied as a permanent installation. The load curve on this unit is well-suited to the mine's needs on this site."

The crane will be erected in a configuration that includes a 65 m jib, a 59,4 m hook height, a 17,6 m counter jib and reusable fixing angles. Its lifting capacity is over 6 tonnes at 25 m.

"The crane will be erected to a hook height of about 40 m and then telescoped to its final height," says Smit. "The standard erection will take three days and telescoping it to the final height will take another two days."

Among the advanced features of this Potain model is the 60LVF25 hoist winch that includes a new power control function.

"While the normal starting power on this tower crane is 62 kVA, the advantage of this function is that the kVA requirements can be lowered to 38 kVA if there is not sufficient power available on the mine," he says.

Smit emphasises that this lower power supply has no effect on the slewing or trolley function of the tower crane, but only reduces the hoisting speed.

Louw Smit, SA French, tel (+27 11) 822-8782

Mobile app for Pitram now available

A new mobile app, Pitram Connect, offering Pitram clients access to a detailed, up to date overview of their mine's data on their smartphones and tablets has been launched by MICROMINE. The app is available on the App Store for iPhone (iOS10 and above) and on Google Play for Android phones (6.0 Marshmallow and above).

"Clients are insisting on more information about their data and want to be able to view that information whenever and wherever they want," says MICROMINE Product Strategy Manager Gareth Dean

"We created the Pitram Connect mobile app to assist all mining business units including production, maintenance, technical services and management to connect them with their mine and give them valuable insights into their data."

The app has all the latest functionality of modern smartphones to create a smooth, efficient and responsive user experience. Users can easily navigate between the different views – performance, equipment, locations and personnel screens – via easy to use icons.

The Pitram Connect mobile app can be used by any Pitram client who has Pitram 4.8 and the PRIS module. Pitram Restful Integration Services (PRIS) allows third party software applications to submit and retrieve Pitram data without needing direct access to the database.

MICROMINE, tel (+27 87) 150-7580, website: www.micromine.com

Lafarge tailors solutions for mining customers

Lafarge South Africa offers high-quality products and services for the mining industry through its cement product line and its subsidiary Ash Resources (supplier of fly ash). The company says that each customer is treated exclusively and not via a 'one-size-fits-all' approach. This results in the products being tailor made to suit each mine's specific requirements.

Product applications include support structures, concrete batching (above ground and underground) and shotcreting.

Over and above providing the different products, Lafarge South Africa and Ash Resources use their expertise to provide an end-to-end service that encompasses mix optimisation, quality testing and technical support.

Through proper mix optimisation, the customers get guaranteed quality and consistency, ultimately resulting in significant cost savings for the mine.

To further ensure the best quality, final trialling and testing is done on product, aggregates and water at the companies' QDSA laboratory.

"Our products offer consistent quality due to the intense internal quality controls at all our production sites and in conjunction with QDSA", says Tshepiso Dumasi, General Manager for Cement and Managing Director for Ash Resources.

Ash Resources currently has five Fly Ash plants across the country: Lethabo (Free State), Majuba (Free State), Matimba (Limpopo), Matla (Mpumalanga) and Kendal (Mpumalanga).

"We work very closely with the mining industry, its professionals and project managers to keep abreast of trends and to always have insight into industry and individual customer needs," adds Dumasi.

Lafarge South Africa, tel (+27 11) 657-0000, Ash Resources, tel (+27 11) 657-2300

ELB completes tippler refurbishment

ELB Engineering Services (ELB) has successfully completed the refurbishment of the first phase – Tippler A – of the Transnet Tippler Refurbishment project at the Transnet Port Elizabeth Manganese Terminal.

ELB's scope of work included the design, supply of new components, stripping, refurbishment of the tippler including mechanicals, structural and electricals and the installation of the two 1964 Strachan and Henshaw tipplers.

The first phase was executed safely and without any health and safety incident. This record has continued into the Tippler B shutdown which started in late November

Although Tippler A was meticulously planned, the 'brownfields' nature of the refurbishment project brought several technical and schedule challenges to the project team. The team skilfully adjusted the execution to the new project demands and cold and hot commissioned the tipplers within a record time.

ELB has completed the refurbishment of the first tippler of the Transnet Tippler Refurbishment project at the Transnet Port Elizabeth Manganese Terminal.

Endurance testing went without incident from the contractor with availability being outstanding since takeover by Transnet.

ELB Engineering Services, tel (+27 11) 772-1400

Aggreko to provide power to Nevsun

Aggreko has signed a 10-year deal to provide solar-diesel hybrid power to Nevsun in Eritrea. The Glasgow-based company will supply 22 MW of diesel and 7,5 MW of solar-generated power for the company's copper and zinc operations.

"We're delighted to be chosen by Nevsun to power their mining operations in Eritrea," said Aggreko's CEO, Chris Weston.

"Technology never stands still, and neither does Aggreko. Our mobile, modular power enables us to make a massive difference to the communities and industries we serve, and our solar-diesel hybrid offering is an example of an innovation that brings cost-effective, reliable, uninterrupted power with additional fuel flexibility to customers."

Aggreko's solar-diesel hybrid power package is said to combine cost-effectiveness and green renewable energy with the reliability of diesel-generated power to provide uninterrupted power round the clock.

The hybrid programme was developed at Aggreko's state-of-the-art manufacturing and technology centre in Dumbarton, Scotland, and uses the latest diesel generators.

They are monitored using Aggreko Remote Monitoring (ARM) telemetry to ensure optimum operational and fuel efficiencies.

Aggreko, website: www.aggreko.com

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